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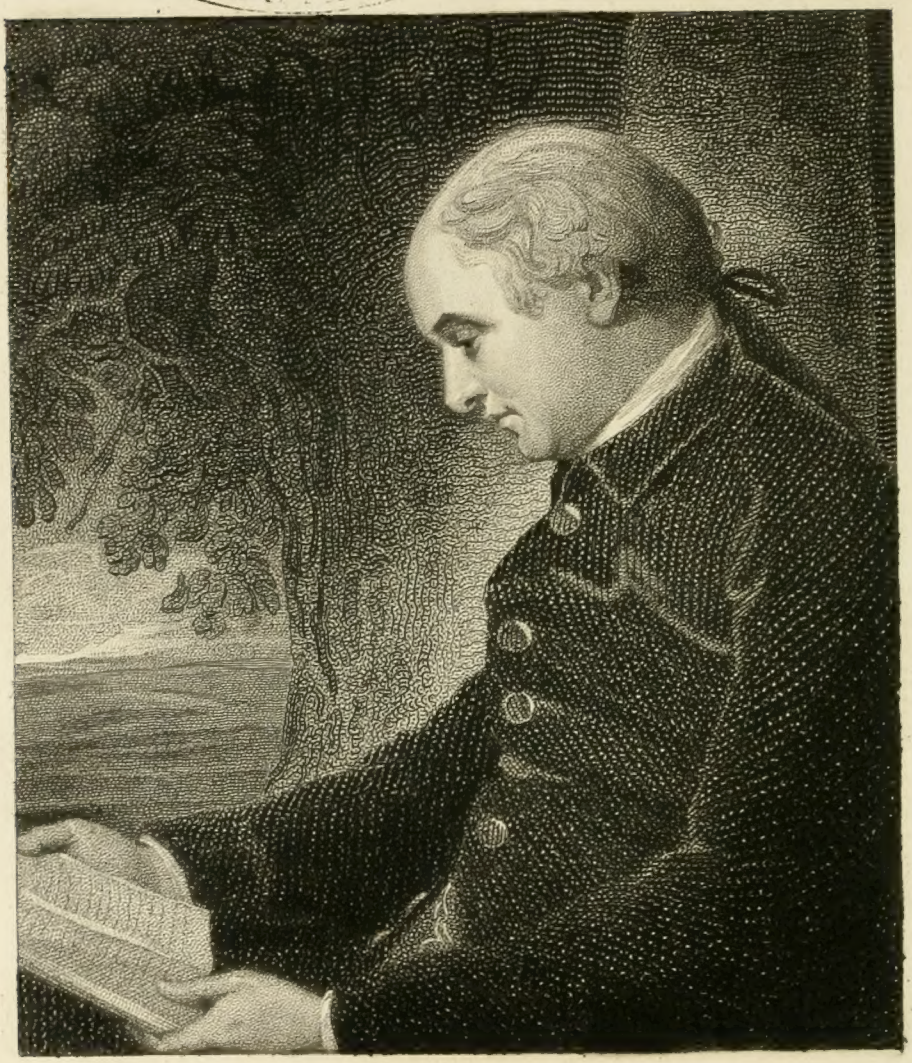

CHARLES DUKE OF RICHMOND,

K.G. F.R.&A.S.

late a Vice President of the Society for the Encouragement of Arts, Manufactures and Commerce

Drawn and Engraved by Wm Evans, from an original Picture by Romney in the Poſſeſsion of the present Duke of Richmond.

P Tech R Royal Society of Arts London

TRANSACTIONS

OF THE

SOCIETY,

INSTITUTED AT LONDON,

FOR THE

ENCOURAGEMENT

OF

ARTS, MANUFACTURES,

AND COMMERCE;

WITH THE

PREMIUMS offered in the Year 1807,

AND

AN ANALYTICAL INDEX

TO THEIR

FIRST TWENTY-FIVE VOLUMES.

VOL. XXVI.

LONDON:

PRINTED BY R. WILKS, CHANCERY-LANE.

Sold by the HOUSEKEEPER, at the SOCIETY'S HOUSE, in the ADELPHI; and by Messrs. ROBSON, J. WHITE, BECKET, JOHNSON, CADELL and DAVIES, PHILLIPS, WALTER, RICHARDSON, LONGMAN and REES, TAYLOR, and WYATT.

[Price TEN SHILLINGS and SIXPENCE.]

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PREFACE.

AS a Tribute of Respect to the Memory of his Grace the late Charles Duke of RICHMOND, K. G. F. R. and A. S. who was elected a Member of the Society in the year 1758, chosen a Vice-President in 1763, and who, for nearly fifty years, contributed to extend the sphere of its utility, by an annual Subscription of five Guineas, the Society instituted for the Encouragement of Arts, Manufactures, and Commerce, have embellished the present Volume with his Portrait, (drawn and engraved with the permission of his noble Successor,) by Mr. Evans, from a Painting executed by Romney.

A period of about fifty-four years has now elapsed since this Society first begun and since continued their attentions, to the various objects of the institution; and they trust that their present Volume will be found to contain much valuable information in the several departments under which their business is usually classed.

Under the Class of Agriculture, the Right Hon. the Earl of Mansfield will be found to have promoted the public

interest, by Planting 96,000 Oak Trees, which may contribute, at a future period, to the service of the Royal Navy, that Bulwark of the British Empire.

The Right Rev. the Lord Bishop of Llandaff, well known for his excellent chemical publications, has lately devoted some part of his leisure to the Planting of 322,500 Larch Trees, which afford useful, valuable, and durable timber.

The Right Hon. Lord Boringdon, by Embankments from the Sea, has gained two hundred and fifteen Acres of Land, which are already become valuable and productive.

Upon a similar plan, William Lawrence, Esq. of Maldon, in Essex, has gained a considerable Tract of Land, and has thus contributed much to the salubrity of that neighbourhood, by removing the morasses and stagnant pools of water which generally occasion the intermittent fevers prevalent in such situations.

The extensive Plantations of Fruit Trees, made at Heffleton, near Wareham, in Dorsetshire, by Dr. Baine, are planned and managed with great judgment. They are well deserving of inspection by all persons who have an opportunity of encouraging this branch of agriculture. They present to the eye great varieties of delightful scenery, highly interesting in every stage of their growth, and such as naturally

turally tend to excite a stimulus in other persons to similar exertions; they also prove the certainty of a very considerable profit soon arising from the timber.

To Mr. Charles Waistell, of High Holborn, the public are much indebted, for a very interesting communication of Methods to ascertain the Value of Growing Timber Trees, at different periods, with a number of useful Hints on the Means of promoting their Growth, and increasing their Value, derived from his actual observation and much attention; and it is probable that the Tables he has given will be generally referred to, as the best examples of the kind hitherto made known.

Much light has been thrown on the Theory of Vegetation, by the very ingenious and entensive Experiments of John Christian Curwen, Esq. of Workington Hall, in Cumberland; it seems evident from them, that the opening of the land by the plough, or other mechanical means, is useful not only in allowing the roots to extend themselves within the soil thus loosened, (a fact universally known, and hitherto regarded as the only cause of their improvement in growth,) but also acts in a manner heretofore unnoticed, namely, by promoting in dry seasons the evaporation of much moisture from the earth thus exposed to the action of the sun and air, and creating a pabulum for the plants, which absorbed by their leaves, renders them in a

high degree luxuriant and productive. He has so far extended his observations on this subject as to show, that the mode of depositing the manure for plants, may be made subservient to this principle, that equally good crops may be produced with a less quantity of it, and the land preserved in better tilth and condition, than the same land would be with a greater quantity of manure, managed by the common practice.

Robert Burrows, Esq. of Great Witchingham, in Norfolk, has been engaged in a very accurate and extensive course of Experiments respecting the Comparative Advantages of Wheat, as sown broadcast, drilled, or dibbled; he has minutely described every operation, and accurately stated the expence of each of these modes of culture, the nature of the soil, condition of the land, produce of the corn, and the quantity of the straw; he has drawn inferences from the products, of the advantages or disadvantages attending each mode of culture.

The Improvement of Waste and Uncultivated Land, by J. Butler, Esq. of Bramshott, in Hampshire, shows an extraordinary increase of value from his judicious management, he having, at a moderate expence, since the year 1804, rendered sixty-six acres of land, then worth only sixteen pounds seven shillings and sixpence per annum,

now

now of the annual value of one hundred and forty-five pounds ten shillings.

Mr. Samuel Curtis, of Walworth, has lately planted a very extensive Orchard, containing above four thousand Fruit Trees of various kinds, which are placed with so much judgment, as to permit the land betwixt the rows of trees to be yet cultivated for a series of years, and to yield nearly as great crops, as if the fruit trees had not been planted.

The Foot Rot in Sheep has been found to be a troublesome and serious disease—the mode of cure pointed out by Mr. R. Parkinson, of Walworth, appears easy to execute, and by very respectable certificates, is stated to be found effectual.

Many valuable Cattle have been lost from eating too much moist clover grass, which, by fermenting in the stomach of the animal, furnishes so great a quantity of air as to occasion suffocation, if not timely disengaged. Two methods of relieving cattle hoven or swelled by this disorder, have been adopted; one of which is by passing a hollow flexible tube down the throat of the animal, and allowing the air to escape through it; the other is, by stabbing the beast through the hide into the stomach, and thence allowing the air a vent through the wound. Mr. William Wallis

Mason, of Goodrest-Lodge, near Warwick, has, instead of a knife, for this latter operation, successfully employed an instrument resembling that used by surgeons in tapping for the dropsy, known by the name of Trochar and Canula.

The usual mode of Churning Cream, to make Butter, is well known to be a laborious operation, but this labour is likely to be now considerably reduced, and the business facilitated, by the simple and ingenious invention of Mr. Thomas Fisher, of Ormskirk: the Head of his Churn-Staff has a rotatory motion upon a pivot at the bottom of the Staff, which completes the work sooner, and with more ease.

The Stall Feeding of Cattle, with a view to ascertain what breeds arrive at the earliest maturity, and have the greatest propensity to fatten, has been considered an object deserving much attention, and has induced the Society to offer two premiums for experiments in this line.

Under the Class of Chemistry, Mr. William Anderson, of his Majesty's Dock-Yard, at Portsmouth, has been rewarded for Improvements in Painting Canvas for Hammock Cloths, and other articles necessary to be guarded from Wet. His process comprizes the advantages of being cheap, soon executed, rendering the canvas pliant, durable,

ble, and longer impervious to water, than that heretofore adopted. He has also furnished some ingenious remarks on converting the colours of old painted canvas again to use.

The benefits arising from plenty of Vegetables as Stores on Shipboard, are too well known to require being expatiated upon, and preserved Fruits form a luxurious and wholesome addition to our repasts at home. The Process of Mr. Saddington, for the Preservation of an infinite Variety of Fruits, without Sugar, has a considerable similarity to some of the modes heretofore used, but he has reduced the plan of preserving fruit to so regular a system, and at so cheap a rate, as to render the communication a desirable circumstance to many persons who have met with serious disappointments in attempts for that purpose.

In the Class of Polite Arts, under pages 19 and 20, will be seen, from the various Rewards bestowed, that the Society have given great encouragement to the efforts of genius in young persons of both sexes, in order to form the taste of those who may in future become patrons of the arts, and to excite a laudable spirit of emulation amongst young professional artists. The very numerous and highly respectable company who attend the annual distribution of the Rewards of the Society, bear ample testimony of the

heart-

heart-felt pleasure derived from contemplating the exertions of rising merit.

In the Class of Manufactures, the Society furnish one instance among many which this united empire affords, of the spirit with which its inhabitants meet the difficulties attempted to be thrown in their way by foreign powers. By the ports of the continent being closed against us, it was expected that our manufactures would be destroyed for want of raw materials on one hand, and for want of sales for our goods on the other. Our enemies had even contemplated, with pleasure, the distress which they expected to arise to our Navy from want of hemp for cables, ropes, and sail-cloth. At this juncture it has been shown, by the experiments of Mr. George Whitworth, of Cuxwold, that fifteen thousand tons of sheeps' wool may be annually advantageously devoted to the manufacture of articles heretofore usually made of hemp; thus furnishing employment to our manufacturers, encouraging and rewarding the farmers, increasing their attention to this article, and allowing the hemp necessarily imported to be exclusively devoted to the service of our Navy.

The ingenuity of our manufacturers in facilitating the detail of their business, is frequently displayed by improvements. The ingenious Implement lately invented by Mr. Peter Tansley, for cutting Shag Edgings, is simple

in

in construction, and affords great facility in executing the work.

Under the class of Mechanics many valuable discoveries are made known to the public, and very particular attention has been paid by the SOCIETY to reward such as are connected with advantages to the Navy. The Society are sensible that it demands the support of every man who has the interest of his country at heart, and they are anxious to contribute all the means in their power, of adding to its security, comfort, and success. Captain Bolton's highly valuable invention for forming ships Jury-masts when the original masts have been broken by storms, or in engagements, shows, that from the spare spars usually carried on board King's ships, and in every merchant ship that is properly equipped, Jury-masts may be constructed to carry securely as much sail as on the usual mast, and so as to enable the ships to prosecute their voyage with safety and without delay.

The improvement in anchors by Captain Ball, renders them more durable, and less liable to damage, than those made in the common way, and of course gives greater security to a ship. His double fish hooks for fishing the anchor effects that business with ease, and without the usual risk.

The

The great scarcity of Oak timber for the Navy, is become a serious object of consideration, and every means for providing a substitute for its use is of much consequence. Mr. Roberts's invention of securing the ends of the beams of ships, by iron work instead of wooden knees, will be a saving in expence of three hundred pounds in the construction of every seventy-four gun ship. He has not only been rewarded by this Society, but after a series of trials this plan has been patronized by his Majesty and the Navy Board.

Telegraphic communication has been found of great use in this kingdom, and every means of facilitating correspondence upon this principle deserves attention. The inventions of Major Charles Le Hardy, of the Chevalier Edelcrantz, and of Mr. Henry Ward, all detailed in the present volume, show great ingenuity in effecting or assisting such communication.

In making inclosures of land great expence frequently arises from raising and removing large stones, partly exposed to view, and partly buried under ground; the easy and simple mode by which Mr. Robert Richardson has effected this business, shows that things may actually be sometimes completely executed in a manner difficult to be accounted for theoretically.

Few persons have escaped the unpleasant sensation of being exposed to the inconvenience of a great current of air between the bottom of a door and a fire-place. Mr. John Tadd's invention will obviate this evil, and allow the door to pass with ease over the floor carpet.

Various means have been attempted by Mechanics to make an universal Screw-Wrench, or an Instrument which could be fitted to the different sized Heads of Screws. The Implement invented for this purpose, by Mr. William Barlow, will be found ingenious, simple, and efficacious.

Few subjects have lately been more the topic of conversation, and of speculation, than the effects of Carbonated Hydrogen Gas, in lighting rooms, factories, or places of public resort. The communication produced to the Society by Mr. Clegg on this matter, will furnish to the public the means of executing plans of this kind, according to modes long established by him, and accurately described in the present volume.

The Society, ever alive to the calls of humanity, have rewarded Captain Manby, for his Improvement for forming a Connection with a Ship stranded, by means of a Rope thrown over the Vessel, from a Mortar on the Shore. From the Engravings and detailed Experiments given

given in the volume, the method is fully shown, and that it is likely to be the means of saving many a brave seaman from a watery grave. The public will no doubt unite in sentiment with the noble President of the Society, who declared, on presenting him with the Gold Medal, that he had great pleasure in observing, that the means which had heretofore been usually employed for the destruction of mankind, were now likely to be advantageously used by Captain Manby for their preservation.

The public will find, under the Class of Colonies and Trade, that attention has been paid to the Encouragement of the British Herring Fisheries, and from the opinions of persons conversant in the business, that the herrings cured by Mr. Errington, of Yarmouth, approach nearer in goodness to those of the Dutch, than any of the British cured white pickled herrings.

The Royal Botanical Garden of St. Vincent will be found to flourish under the superintendency and care of Dr. Alexander Anderson, who appears indefatigable in pursuit of the objects of that establishment. We greatly lament with him, that owing to difficulties at the Custom-house, many valuable Articles of Natural History are frequently lost or injured, and the kingdom deprived of products which would eventually improve its manufactures, and extend its commerce.

The

The Communications from Dr. William Roxburgh, of Calcutta, show his accustomed zeal for promoting the interests of his native country, and the great resources to which it can have recourse, without resorting for assistance to other powers; it is a circumstance highly gratifying, to find that Canvas of very good quality for ship sails, can be furnished advantageously for the Navy, from our East India settlements, and that Hemp produced there, is reckoned equal, if not superior, to Russian Hemp.

A perusal of the present Volume will convince the public, that the Society have paid great attention during their Session, to general Improvements in the Arts, Manufactures, and Commerce of the British Empire, for the promotion of which they were established, and they trust their labours will meet with general approbation.

The Meetings of the present Session commenced in October last, and are numerously attended; the business is conducted with their usual alacrity; and the Society are ever ready to patronise, not only the immediate objects of the Premiums they have offered, but are disposed to extend it to every other invention consistent with the plan of the institution.

The Society take the present opportunity of expressing their thanks to the several Public Bodies and individuals from

from whom they have received the sundry presents noted in this volume, and are particularly obliged to Alexander Mitchell, Esq. for the valuable additions to their library, with which he has favoured them from time to time, and hope that his example will be followed by other Members of the Society, and the Friends of this Establishment.

The Society desire it to be clearly understood, that as a body they are not responsible for any opinion or representation of facts contained in the following pages. They have endeavoured only to compress, into a form more concise, such communications as appeared to them too diffuse when received.

A great increase in the number of Members hath taken place during the last Session, and the Finances of the Society are in a very flourishing state. There is probably no other Institution in the world where the Members have such opportunities of acquiring useful knowledge, and enjoying such patronage and privileges. To every improvement or invention by which the happiness of mankind can be promoted, the Views of the Society are extended, and their Bounties and Rewards reach the remotest climates.

Adelphi, London,
Dec. 30, 1808.

PREMIUMS offered in 1808, *by the* SOCIETY *instituted at* London, *A. D.* 1754, *for the Encouragement of Arts, Manufactures, and Commerce, with a List of the present Officers.*

PRESIDENT.

Charles, Duke of Norfolk, F. R. and A. S

VICE-PRESIDENTS.

Wm. Henry, Duke of Portland, F. R. and A. S.
Hugh, Duke of Northumberland, F. R. and A. S.
George, Earl of Dartmouth, K. G. and F. R. S.
Jacob, Earl of Radnor, F. R. and A. S.
Charles, Earl of Liverpool, L. L. D.
Charles, Earl of Romney, F. R. S.
Hon. Robert Clifford, F. R. and A. S.
Sir William Dolben, Bart. L. L. D.
Sir Robert Peel, Bart. M. P.
Sir Watkin Lewes, Knt.
Thomas Pitt, Esq. F. A. S.
Caleb Whitefoord, Esq. F. R. and A. S.
Richard Clark, Esq. Chamberlain.
Nathaniel Conant, Esq.
Richard Powell, M. D.
Thomas Rowcroft, Esq. Alderman.

CHAIRMEN OF COMMITTEES.

Accounts.
William Lumley, Esq.
Abraham Osorio, Esq.

Correspondence and Papers.
Alexander Tilloch, Esq.
William Tooke, Esq.

Polite Arts.
J. Flaxman, Esq. R. A.
J. T. Barber, Esq.

Agriculture.
Matthias Deane, Esq.
T. H. Andrew, Esq.

Manufactures.
J. Pearsall, Esq.
J. Trelawny, Esq.

Mechanics.
Thomas Jones, Esq.
Kenworthy Cooke, Esq.

Chemistry.
Henry Coxwell, Esq.
G. D. Midgley, Esq.

Colonies and Trade.
William Lewis, Esq. F. L. S.
J. Spencer Smith, L. L. D.

Miscellaneous Matters.
Joseph Jacob, Esq.
William Kirkby, Esq.

SECRETARY, Charles Taylor, M. D.
ASSISTANT SECRETARY, Mr. Thomas Woodfall.
HOUSEKEEPER, Miss A. B. Cockings.
COLLECTOR, Mr. Robert Elwin.

ADVERTISEMENT TO THE PUBLIC.

THE chief objects of the SOCIETY are to promote the Arts, Manufactures, and Commerce of this Kingdom, by giving honorary or pecuniary Rewards, as seem to them best adapted to the case, for all such useful Inventions, Discoveries, and Improvements, (though not mentioned in this book) as tend to that purpose; and, in pursuance of this plan, the Society have already expended many THOUSAND POUNDS, advanced by voluntary subscriptions of their members, and legacies bequeathed.

The Register of the Premiums and Bounties they have given, which may be seen at the SOCIETY'S house in the *Adelphi*, will show the very great advantages which the Public have derived from this Institution.

The meetings of the SOCIETY are held every *Wednesday*, at seven o'clock in the evening, from the fourth *Wednesday* in *October* to the first *Wednesday* in *June*. The several Committees meet on other evenings in the week during the session, as particularly mentioned in their printed book of Rules and Orders.

In order still farther to promote the laudable Views of the SOCIETY, it may be necessary to explain the mode by which members are elected.

Each member has the privilege, at the meetings of the SOCIETY, or by letter to the Secretary, to propose any person who is desirous to become a member, provided the proposal contains the name, with the full addition, and place of abode, of the proposed member, and is signed by three members of the SOCIETY.

Peers of the Realm or Lords of Parliament are, on their being proposed, immediately ballotted for; the names of other persons proposed to become members are to be delivered to the Secretary, read at the next meeting of the SOCIETY, and then inserted in lists which are hung up in the Society's room: they are ballotted for at the second following ordinary meeting. In both cases, if two-thirds of the members then voting ballot in their favour, they are deemed perpetual members upon payment of not less than Twenty Guineas in one sum, or subscribing members upon payment of any sum not less than Two Guineas annually.

All members are entitled to vote and assist in all the business of the SOCIETY, and the several Committees. The members have also the privilege of recommending two persons as auditors at the meetings of the SOCIETY, and by addressing a note to the housekeeper, of introducing their friends to examine the various Models, Machines, and Productions, in different branches of Arts, Manufactures, and Commerce, for which rewards have been bestowed; also to inspect the magnificent series of moral and historical Paintings, executed by the late J. BARRY, Esq. which, with some valuable Busts, Statues, &c. decorate the Great Room.

Members have the use of the Society's Library, which is valuable and annually increasing, from donations of scientific and useful books and engravings. The SOCIETY are highly sensible of the great importance of such acquisitions, and are happy to record them, with the names of the donors, in the Volume annually published of the SOCIETY'S Transactions, to which the members are entitled.

Ladies are eligible as members of the SOCIETY, to all the Privileges thereof, and are alone entitled to vote by proxy at elections, through the medium of any gentleman who is a member, on his producing a written authority for the same.

The time appointed for admission to the Paintings or Models, is from ten to two o'clock, Sundays and Wednesdays excepted.

ORDERED, SOCIETY'S HOUSE, ADELPHI, JUNE 1st, 1808.

That the several Candidates and Claimants, to whom the Society shall adjudge Premiums or Bounties, do attend at the Society's House, in the Adelphi, on the last Tuesday, in May, 1809, at Eleven o'Clock in the Morning precisely, to receive the same; that Day being appointed by the Society for the Distribution of their Rewards: And before that time no Premium or Bounty will be delivered, excepting to those who are about to leave the Kingdom.

In cases where the Society may think fit to admit excuses for not attending in person, Deputies may be substituted to receive the Rewards, provided such Deputies are either Members of the Society, or superior Officers thereof.

PREMIUMS IN AGRICULTURE.

Article 1. ACORNS.

FOR having set between the first of October, 1806, and the first of April, 1807, the greatest quantity of land, not less than ten acres, with acorns, with or without seeds, cuttings, or plants of other trees, at the option of the candidate; and for effectually fencing and preserving the same, in order to raise timber; the gold medal.

2. For the second greatest quantity of land, not less than five acres, set agreeably to the above conditions; the silver medal.

Certificates of setting agreeably to the above conditions, and that there are not fewer than three hundred young oaks on each acre, to be delivered to the Society on or before the first Tuesday in December, 1808.

3. RAISING OAKS. To the person who shall have raised, since the year 1804, the greatest number of oaks, not fewer than five thousand, either from young plants or acorns, in order to secure a succession of oak timber in this kingdom; the gold medal.

4. For the next greatest number, not fewer than three thousand; the silver medal.

Certificates that there were on the land, at least the number of young oak-trees required, in a thriving condition, two years after the planting, with an account of the methods pursued in making and managing the plantation, to be produced to the society on or before the first Tuesday in January, 1809.

5. ASCERTAINING THE BEST METHOD OF RAISING OAKS. To the person who shall ascertain in the best manner, by actual experiments, the comparative merits of the different modes of raising oaks for timber, either from acorns set on land properly dug or tilled, from acorns set by the spade or dibble, without digging or tillage, either on a smooth surface, or among bushes, fern, or other cover; or from young plants previously raised in nurseries, and transplanted; regard being had to the expense, growth, and other respective advantages of the several methods; the gold medal.

The *accounts*, and proper *certificates*, that not less than one acre has been cultivated in each mode, to be produced to the Society on or before the first Tuesday in November, 1808.

6. CHESNUTS. For having sown or set, between the first of October, 1806, and the first of April, 1807, the greatest quantity of land, not less than six acres, with Spanish chesnuts, with or without seeds, cuttings, or plants of other trees, adapted to such soil, at the option of the candidate; and for effectually fencing and preserving the same, in order to raise timber; the gold medal.

7. For the second greater quantity, not less than four acres; the silver medal.

Certificates of sowing or setting, agreeably to the above conditions, and that there are not fewer than three hundred chesnut plants in a thriving state, on each acre, to be delivered to the Society on or before the first Tuesday in January, 1809.

8. ELM. For having planted the greatest number of the English elm, not less than eight thousand, between the twenty-fourth of June, 1806, and the twenty-fourth of June, 1807; and for having effectually fenced and preserved the same in order to raise timber; the gold medal.

9. For the second greatest number, not less than five thousand; the silver medal.

Certificates of having planted agreeably to the above conditions, that the plants were in a healthy and thriving state two years at least after making the plantation, and specifying the distance of the plants, to be delivered to the Society on or before the first Tuesday in April, 1809.

10. LARCH. For having planted out, between the twenty-fourth of June, 1805, and the twenty-fourth of June, 1806, the greatest number of larch-trees, not fewer than five thousand, and for having effectually fenced and preserved the same in order to raise timber; the gold medal.

11. For the next greatest number, not fewer than three thousand; the silver medal.

Certificates of the number of plants, that they were in a healthy and thriving state two years at least after they were planted out, with a general account of the methods used in making the plantation, to be delivered to the Society on or before the last Tuesday in December, 1808.

N. B. The larch-trees may be planted, either mixed with other trees, or by themselves, as may best suit the convenience of the planter.

12. ASH. For having sown or set, in the year 1805, the greatest quantity of land, not less than six acres, with ash for timber, with or without seed, cuttings, or plants, of such other trees as are adapted to the soil; the gold medal.

13. For the next greatest quantity, not less than four acres; the silver medal.

Certificates of the sowing or setting, agreeably to the above conditions, that there are not fewer than six hundred ash plants on each acre, in a thriving and healthy condition, two years at least after the sowing or setting, with a general account of the methods used in making the plantation; to be delivered to the Society on or before the last Tuesday in December, 1808.

N. B. It is the intention of the Society, that such lands only as are not calculated for the purposes of Husbandry, should be employed for the purposes specified in these advertisements.

14. FOREST-TREES. To the person who shall have enclosed and planted, or set, the greatest number of acres (not less than ten) of land, that is incapable of being ploughed, such as the borders of rivers, the sides of precipices, and any land that has too many rocks, or that is not calculated to repay the expense of tillage, owing to the surface be-

ing too hilly, mountainous, or otherwise unfit for tillage, with the best sorts of forest-trees, namely, oak, Spanish chesnuts, ash, elm, beech, alder, willow, larch, spruce, and silver fir, with or without screens of Scotch fir, adapted to the soil, and intended for timber-trees, between the first of October, 1805, and the first of April, 1806; the gold medal.

15. For the second greatest quantity of land, not less than seven acres; the silver medal.

A particular *account* of the methods used in making and managing the plantations, the nature of the soil, the probable number of each sort of plants, together with proper *certificates* that they were in a healthy and thriving state two years at least after making the plantation, to be delivered to the Society on or before the first Tuesday in December, 1808.

N. B. With the above forest-trees, the seeds, cuttings, or plants, of such other trees as are adapted to the soil, and proper for underwood, may or may not be intermixed.

The candidates for planting all kinds of trees are to produce certificates that the respective plantations are properly fenced and secured, and particularly to state the condition of the plants at the time of signing such certificates. Any information which the candidates for the foregoing premiums may choose to communicate, relative to the methods made use of in forming the plantations, or promoting the growth of the several trees, or any other observations that may have occurred on the subject, will be thankfully received.

16. Securing Plantations of Timber-Trees, and Hedge-Rows. To the person who shall give to the Society the most satisfactory account, founded on experience, of the most effectual and least expensive method of securing young plantations of timber-trees, and hedge-rows, from hares and rabbits, as well as sheep and larger cattle, which at the same time shall be least subject to the depredations of wood-stealers; the silver medal.

The *accounts*, and *certificates* of the efficacy of the method, to be produced to the Society on or before the first Tuesday in December, 1808.

17. Comparative Culture of Wheat, broad-cast, drilled, and dibbled. For the best set of experiments, made on not less than twelve acres, four of which to be sown broad-cast, four drilled, and four dibbled, the two latter in equidistant rows, in order fully to ascertain which is the most advantageous mode of cultivating wheat; the gold medal.

It is required that every operation and expense of each mode of culture be fully described: and that proper *certificates* of the nature and condition of the land on which the experiments were made, together with an *account* of the produce of the corn, the weight per bushel, and also of the straw, be produced to the Society on or before the first Tuesday in February, 1809.

18. Beans and Wheat. To the person who shall have dibbled or drilled between the first of December, 1807, and the 1st of April, 1808, the greatest quantity of land, not less than ten acres, with beans, in equidistant rows, and hoed the intervals twice or oftener, and shall have sown the same land with wheat in the autumn of the year 1808; the gold medal.

It is required that an *account* of the sort and quantity of beans, the time of dibbling or drilling, and of reaping or mowing them, the produce per acre thrashed, the expense of dibbling or drilling, hand or horse hoeing, the distance of the rows, and the quality of the soil, together with *certificates* of the number of acres, and that the land was afterwards actually sown with wheat, be produced on or before the second Tuesday in March, 1809.

19. Beans. To the person who, in the year 1806, shall discover and cultivate, either by the drill or dibbling method, on not less than five acres, a species of horse-beans or tick-beans, that will ripen their seeds before the 21st of August; the silver medal.

It is required that a particular account of the bean, the cultivation, and the expense attending it, with proper *certificates* of the nature and condition of the land on which the experiments were made, together with an *account* of the produce, the weight per Winchester bushel, and a sample of not less than a peck, be produced to the Society on or before the first Tuesday in December, 1808. It is apprehended that if a bean should be brought into cultivation with the habits of the hotspur, or other early peas, that it would in a great measure escape the danger arising from the collier-insect, or other insects, and allow more time for the farmers to till the land for the subsequent crop of wheat. The *accounts* and *certificates* to be delivered on or before the first Tuesday in December, 1808.

20. Parsnips. To the person who in the year 1808, shall cultivate the greatest quantity of land, not less than five acres, with parsnips, for the sole purpose of feeding cattle or sheep; the gold medal.

Certificates of the quantity of land so cultivated, with a particular *account* of the nature of the soil and weight of the produce on sixteen perches, and also of the condition of the cattle or sheep fed with the parsnips, and the advantages resulting from the practice, to be produced to the Society on or before the second Tuesday in February, 1809.

21. Buck Wheat. To the person who shall cultivate the greatest quantity of land with buck wheat, not less than thirty acres; the gold medal.

It is required that the time of sowing and reaping be noticed; also a particular *account* of the species, cultivation, and expense attending it, the manner of reaping it, thrashing it, and housing the grain; with proper

certificates of the nature and condition of the land on which the experiments were made, and the name of the crop, if any, which the same land bore the preceding year, together with an *account* of the produce, and a sample of the seed, not less than a quart, be produced to the Society on or before the second Tuesday in January, 1809.

22. For the next greatest quantity, not less than fifteen acres, on similar conditions; the silver medal.

Information respecting its application to the feeding of cattle, hogs, and poultry, and other of its uses, is also desired. It is known to be particularly serviceable in furnishing honey to bees.

23. RAISING GRASS SEEDS. To the person who shall raise the greatest quantity of each of any of the following named grass seeds, *viz.*—Meadow fox-tail (alopecurus pratensis), sweet-scented vernal grass (anthoxanthum odoratum), Timothy grass (phleum pratense), meadow fescue grass (festuca pratensis), smooth-stalked meadow grass (poa pratensis), rough-stalked meadow grass (poa trivialis); the silver medal.

It is required that *certificates* from persons who have viewed them in a proper state, to identify that they are one or other of the seeds above mentioned, indicating clearly the particular species, and noticing the quantity produced of such seeds, free from weeds or mixture of other grasses, together with proper samples of the seeds, be produced to the Society on or before the first day of February, 1809.

24. PRESERVING TURNIPS. To the person who shall discover to the Society the best and cheapest method of preserving turnips perfectly sound, and in every respect fit for the purpose of supporting and fattening sheep and neat cattle during the months of February, March, and April; the gold medal.

It is required that a full and accurate *account* of the method employed, and the expense attending the process, together with *certificates* that the produce of four acres at the least have been preserved according to the method described, and applied to the feeding of sheep and neat cattle; that the whole were drawn out of the ground before the first day of February, in order to clear the greater part of it previous to its being prepared for corn, and to save the soil from being exhausted by the turnips; and also of the weight of an average sixteen perches of the crop; be produced to the Society on or before the first Tuesday in December, 1808.

25. For the next in quantity and merit, on not less than two acres; the silver medal.

26. PRESERVING CABBAGES. To the person who shall discover to the Society the best and cheapest method of preserving drum-headed cabbages perfectly sound, and in every respect fit for the purpose of supporting and fattening sheep and neat cattle during the months of February, March, and April; the gold medal.

27. For the next in quantity and merit, on not less than two acres; the silver medal.

Conditions the same as for preserving turnips, Art. 24. And the *accounts* to be produced on or before the first Tuesday in December, 1808.

28. PRESERVING CARROTS, PARSNIPS, OR BEETS. To the person who shall discover to the Society the best and cheapest method of preserving carrots, parsnips, or beets, perfectly sound, and in every respect fit for the purpose of supporting horses, and fattening sheep and neat cattle, during the months of February, March, and April; the gold medal.

Conditions the same as for preserving turnips, Art. 24. And the *accounts* to be delivered in on or before the first Tuesday in December, 1808.

29. For the next in quantity and merit, on not less than two acres; the silver medal.

30. PRESERVING POTATOES. To the person who shall discover to the Society the best and cheapest method of preserving potatoes, two or more years, perfectly sound, without vegetating, and in every other respect fit for the purpose of sets and the use of the table, and consequently of supporting and fattening cattle; the gold medal, or thirty guineas.

It is required that a full and accurate *account* of the method employed, and the expense attending the process, with *certificates* that one hundred bushels at the least have been preserved according to the method described, and that one or more bushels of the same potatoes have been set, and produced a crop without any apparent diminution of their vegetative power, and also that they have been used at table, with entire satisfaction to the person who eat of them, together with a sample of one bushel, be sent to the Society on or before the first Tuesday in December, 1808.

31. For the next greatest quantity, not less than fifty bushels; the silver medal.

32. MAKING MEADOW-HAY IN WET WEATHER. To the person who shall discover to the Society the best and cheapest method, superior to any hitherto practised, of making meadow-hay in wet weather; the gold medal.

A full *account* of the method employed, and of the expense attending the process, with not less than fifty-six pounds of the hay; and *certificates* that at least the produce of six acres of land has been made according to the method described, and that the whole is of equal quality with the sample; to be produced on or before the first Tuesday in January, 1808.

33. HARVESTING CORN IN WET WEATHER. To the person who shall discover to the Society the best and cheapest method, superior to any hitherto practised, of harvesting corn in wet weather; the gold medal.

A full *account* of the method employed, and of the expense attending the process, with not less than two sheaves of the corn, and *certificates* that at least the produce of ten acres has been harvested according to the method described, and that the whole is of equal quality with the samples, to be produced on or before the first Tuesday in January, 1809.

34. GAINING LAND FROM THE SEA. To the person who shall produce to the Society an account, verified by actual experiment, of his having gained the greatest quantity of land from the sea, not less than fifty acres, on the coast of Great Britain or Ireland; the gold medal.

Certificates of the quantity of land, and that the experiments were begun after the first of January, 1802, to be produced to the Society on or before the last Tuesday in November, 1808.

35. The same premium is extended one year farther.

Certificates to be produced on or before the last Tuesday in November, 1809.

36. IMPROVING LAND LYING WASTE. For the most satisfactory *account* of the best method of improving any of the following soils, being land lying waste or uncultivated, *viz.* clay, gravel, sand, chalk, peat-earth, and bog, verified by experiments on not less than fifty acres of land; the gold medal.

37. For the next greatest quantity, not less than thirty acres; the silver medal.

It is required, that the land, before such improvement, be absolutely uncultivated, and in a great measure useless, and that, in its improved state, it be enclosed, cultivated, and divided into closes.

Certificates of the number of acres, of the quality of the land so improved, with a full *account* of every operation and expense attending such improvement, the state it is in as to the proportion of grass to arable, and the average value thereof, to be produced on or before the first Tuesday in February, 1809.

38. MANURES. For the most satisfactory set of experiments, to ascertain the comparative advantages of the following manures, used as top-dressings on grass and corn land, *viz.* soot, coal-ashes, wood-ashes, lime, gypsum, night-soil, or any other fit article; the gold medal. It is required that the above experiments be made between two or more of the above-mentioned manures, and that no less than two acres of land be dressed with each manure.

An *account* of the nature of the soil, quantity, and expense of the manure and crops, with *certificates*, to be produced on or before the last Tuesday in February, 1809.

39. RAISING WATER FOR THE IRRIGATION OF LAND. To the person who shall discover to the Society the cheapest and most effectual method of raising water in quantities sufficient to be beneficially employed for the purpose of irrigating land, superior to, and cheaper than any other method now in use; the gold medal, or fifty guineas.

A model, on a scale of one inch to a foot, with *certificates* that a machine at large, on the same construction, has been used, specifying the quantity of water delivered in gallons per hour, and the height to which it was raised, to be produced to the Society on or before the first of March, 1809.

40. PARING PLOUGH. To the person who shall invent and produce to the Society a machine or plough for the purpose of paring land preparatory to burning, superior to any hitherto known, or in use for such purpose, and to be worked by not more than one man and two horses; the silver medal, or twenty guineas.

The machine, and *certificates* that at least three acres have been pared by it in a proper manner, to be produced to the Society on or before the first of January, 1809.

41. MACHINE FOR DIBBLING WHEAT. To the person who shall invent a machine, superior to any hitherto known or in use, to answer the purpose of dibbling wheat, by which the holes for receiving the grain may be made at equal distances and proper depths; the silver medal and ten guineas.

The *machine*, with *certificates* that at least three acres have been dibbled by it, to be produced to the Society on or before the second Tuesday in January, 1809.

42. MACHINE FOR REAPING OR MOWING CORN. For inventing a machine to answer the purpose of mowing or reaping wheat, rye, barley, oats, or beans, by which it may be done more expeditiously and cheaper than by any method now practised, provided it does not shed the corn or pulse more than the methods in common practice, and that it lays the straw in such a manner that it may be easily gathered up for binding; the gold medal.

The *machine*, with *certificates* that at least three acres have been cut by it, to be produced to the Society on or before the second Tuesday in December, 1808. Simplicity and cheapness in the construction of this and the preceding machine, will be considered as principal parts of their merit.

43. THRASHING MACHINE. To the person who shall invent a machine by which corn of all sorts may be thrashed more expeditiously, effectually, and at a less expense, than by any method now in use; the gold medal.

The *machine*, or a model, with proper *certificates* that such a machine has been usefully applied, that at least thirty quarters have been thrashed by it, and of the time employed in the operation, to be produced to the Society on or before the last Tuesday in February, 1809.

44. DESTROYING THE GRUB OF THE COCKCHAFER. To the person who shall dis-

cover to the Society an effectual method, verified by repeated and satisfactory trials, of destroying the grub of the cockchafer, or of preventing or checking the destructive effects which always attend corn, peas, beans, and turnips, when attacked by those insects; the gold medal.

The *accounts*, with proper *certificates*, to be produced on or before the first Tuesday in January, 1809.

45. DESTROYING WORMS. To the person who shall discover to the Society an effectual method, verified by repeated and satisfactory trials, of destroying worms, or of preventing the destrucive effects they occasion on corn, beans, pease, or other pulse; the silver medal.

The *accounts*, with proper *certificates*, to be produced to the Society on or before the first Tuesday in January, 1809.

46. DESTROYING THE FLY ON HOPS. To the person who shall discover to the Society an easy and efficacious method of destroying the fly on hops, superior to any hitherto known or practised, on not less than four acres of hop ground; the gold medal.

Accounts and *certificates* to be delivered to the Society on or before the first Tuesday in February, 1809.

47. PREVENTING THE BLIGHT, OR RAVAGES OF INSECTS, ON FRUIT-TREES AND CULINARY PLANTS. To the person who shall discover to the Society the most effectual method of preventing the blight or ravages of insects on fruit-trees and culinary plants, superior to any hitherto known or practised, and verified by actual and comparative experiments; the silver medal.

The *accounts*, with proper *certificates*, to be delivered to the Society on or before the second Tuesday in December, 1808.

48. CURE OF THE ROT IN SHEEP. To the person who shall discover to the Society the best and most effectual method of curing the rot in sheep, verified by repeated and satisfactory experiments; the gold medal.

It is expected that the candidates furnish accurate *accounts* of the symptoms and cure of the disease, together with the imputed cause thereof, and the actual or probable means of prevention, which, with proper *certificates*, must be delivered to the Society on or before the first Tuesday in February, 1809.

49. CURE OF THE FOOT-ROT IN SHEEP. To the person who shall discover to the Society the best and most effectual method of curing the foot-rot in sheep; the silver medal.

It is required that the cure be ascertained by repeated and satisfactory experiments, and the method of performing it be verified by proper *certificates* delivered to the Society on or before the first Tuesday in February, 1809.

50. PREVENTING THE ILL EFFECTS OF FLIES ON SHEEP. To the person who shall discover to the Society the most effectual method of protecting sheep from being disturbed and injured by flies; the silver medal.

It is required, that the method be ascertained by repeated experiments, and that a *certificate* of its efficacy be delivered to the Society on or before the first Tuesday in December, 1808.

51. PROTECTING SHEEP. To the person who, in the year 1807, shall protect the greatest number of sheep, not fewer than one hundred, by hovels, sheds, or any other means, and give the most satisfactory account, verified by experiment, of the advantages arising from the practice of protecting sheep from the inclemency of the weather, by hovels, sheds, or any other means; the gold medal.

A particular *account* of the experiments made, with the advantages arising therefrom, together with the expense, and *certificates* of its utility, to be produced to the Society on or before the first Tuesday in March, 1808.

N. B. It is required that the *certificates* shall specify the length of time the sheep were so protected, and the manner in which they were maintained during that time; together with the general method of managing them.

52. CULTURE OF HEMP IN CERTAIN PARTS OF SCOTLAND. The Society wishing to encourage the growth of hemp for the use of the navy in certain parts of Scotland, comprehending the whole county of Argyle, that part of Perthshire, situated to the north of the river Tay, and west of the Military Road (see Ainsley's Map of Scotland) leading from Logierait to the county of Inverness, and such other parts of Scotland as lie north of Inverness-shire, offers to the person who shall sow with hemp, in drills at least eighteen inches asunder, the greatest quantity of land in the above-mentioned district, not less than fifty acres statute measure, in the year 1808, and shall at the proper season cause to be plucked the summer hemp, (or male hemp bearing no seed) and continue the winter hemp (or female hemp bearing seed) on the ground until the seed is ripe; the gold medal.

53. To the person who shall sow with hemp, in drills at least eighteen inches asunder, the next greatest quantity of land in the above-mentioned district, not less than twenty-five acres, statute measure, in the year 1808, and shall at the proper season cause the same to be plucked as above-mentioned; the silver medal.

Certificates of the number of acres, of the distance of the drills, of the plucking of the hemp, with a general *account* of the soil, cultivation, and produce, to be delivered to the Society, along with fourteen pounds of the hemp and two quarts of the seed, on or before the second Tuesday in January, 1809.

* 53. FEEDING OF CATTLE. For the best experiments on stall feeding of cattle (not less than five head) to be continued for the space of twelve months, in order to prove

the earliest maturity and greatest propensity to fatten, of the most approved breeds of cattle in Great Britain, specifying the nature of the food given, together with the daily consumption of each beast, with its weekly increase in weight, and such other observations as may be deemed of consequence; the gold medal.

A full *account* of the methods employed, and of the expenses attending the same, and *certificates* of the sundry matters stated, to be produced on or before the second Tuesday in January, 1810.

PREMIUMS FOR DISCOVERIES AND IMPROVEMENTS IN CHEMISTRY, DYING, AND MINERALOGY.

54. Preserving Seeds of Vegetables. For the best method of preserving the Seeds of plants in a state fit for vegetation a longer time than has hitherto been practised, such method being superior to any known to the public, and verified by sufficient trial, to be communicated to the Society on or before the first Tuesday in December, 1808; the gold medal, or thirty guineas.

55. Preventing the Dry-Rot in Timber. To the person who shall discover to the Society the cause of the dry-rot in timber, and disclose a certain method of prevention superior to any hitherto known; the gold medal, or thirty guineas.

The *accounts* of the cause, and method of prevention, confirmed by repeated experiments, to be produced to the Society on or before the second Tuesday in Dec. 1808.

56. Preserving salted Provisions from becoming rancid or rusty. To the person who shall discover to the Society the best, cheapest, and most efficacious method of preserving salted provisions from growing rancid or rusty; the gold medal, or thirty guineas.

A full *description* of the method, with proper *certificates* that it has been found, on repeated trials, to answer the purpose intended, to be produced to the Society on or before the first Tuesday in February, 1809.

57. Refining Whale or Seal Oil. For disclosing to the Society an effectual method of purifying whale or seal oil from the glutinous matter that incrusts the wicks of lamps, and extinguishes the light, though fully supplied with oil; the gold medal, or fifty guineas.

It is required that the whole of the process be fully and fairly disclosed, in order that satisfactory experiments may be made by the Society to determine the validity of the claim; and *certificates* that not less than twenty gallons have been purified according to the process delivered in, together with two gallons of the oil, in its unpurified state and two gallons so refined, to be produced to the Society, on or before the Second Tuesday in February, 1809.

58. Manufacturing Tallow Candles. To the person who shall discover to the Society a method of hardening or otherwise preparing tallow, so that candles may be made of it which will burn as clear and with as small a wick as wax candles, without running, and may be afforded at a less expense than any at present made with spermaceti; the gold medal, or thirty guineas.

Certificates that 112lb. of such tallow have been made into candles, and 12lb. of the candles made thereof, to be produced to the Society on or before the second Tuesday in January, 1809.

59. Candles from Resin or other Substances. To the person who shall discover to the Society the best method of making candles of resin, or any other substance, fit for common use, at a price much inferior to those made of tallow only; the gold medal, or thirty guineas.

Six pounds at least of the candles so prepared, with an *account* of the process, to be delivered to the Society on or before the first Tuesday in December, 1808.

60. Method of separating Sugar in a solid Form from Treacle. To the person who shall discover to the Society the best method of separating sugar from treacle, in a solid form, at such an expense as will render it advantageous to the public; the gold medal, or fifty guineas.

A quantity of the sugar so prepared, in a solid form, not less than thirty pounds weight, with an *account* of the process, and *certificates* that not less than one hundred weight has been prepared, to be produced to the Society on or before the first Tuesday in February, 1809.

61. Increasing Steam. To the person who shall invent and discover to the Society a method, verified by actual experiments, of increasing the quantity or force of steam, in steam-engines with less fuel than has hitherto been employed, provided that in general the whole amount of the expenses in using steam-engines may be considerably lessened; the gold medal, or thirty guineas.

To be communicated to the Society on or before the first Tuesday in January, 1809.

62. Substitute for Tar. To the person who shall invent and discover to the Society the best substitute for Stockholm tar, equal in all its properties to the best of that kind, and prepared from materials the produce of Great Britain; the gold medal, or one hundred guineas. A quantity of the substitute, not less than one hundred weight, with *certificates* that at least one ton has been manufactured, and that it can be afforded at a price not exceeding that of the best foreign tar, together with an *account* of the process, to be delivered to the Society on or before the first Tuesday in March, 1809.

63. Preparation of Tan. To the person who shall prepare, in the most concentrated form, so as to be easily portable, and at a price applicable to the purposes of manufacturers, the largest quantity, not less

than one hundred weight, of the principle called by the French *tannin*, which abounds in oak-bark and many other vegetable substances: the gold medal, or thirty guineas.

Certificates of the superior quality of the quantity so prepared, and a sample of not less than 28lb. to be produced to the Society on or before the last Tuesday in January, 1809.

64. INDELIBLE INK. To the person who shall discover to the Society a method of making a black ink proper for writing, superior to any at present known, indestructible by chemical applications, and not dearer than that which is now in common use; the silver medal, or fifteen guineas.

Certificates that not less than two gallons of such ink have been actually prepared, and found to possess the qualities above mentioned, with a full detail of the process of making it, and two quarts of the ink, to be delivered to the Society on or before the second Tuesday in January, 1809.

65. PREPARATION OF A RED STAIN FOR COTTON CLOTH. To the person who shall communicate to the Society the cheapest and most effectual method of printing or staining cotton cloths with a red colour, by an immediate application of the colouring matter to the cloth, equally beautiful and durable with the red colours now generally procured from decoctions of madder; the gold medal, or thirty guineas.

Certificates that the above process has been advantageously used on ten pieces of calico, each twenty-one yards or upwards in length; one piece of the calico so printed, a quart of the colour in a liquid state, and a full *account* of the preparation and application, to be produced to the Society on or before the second Tuesday in January, 1809.

66 PREPARATION OF A GREEN COLOUR FOR PAINTING COTTON CLOTH. To the person who shall communicate to the Society the best and cheapest method of printing with a full green colour on cotton cloth, by an immediate application of the colouring matter from a wooden block to the cloth, equally beautiful and durable as the colours now formed from the complicated process of the decoction of weld on alumine, and the solutions of indigo by earths or alkaline salts; the gold medal, or thirty guineas.

Certificates and conditions as for premium 65.

67. RENDERING MUSLIN LESS COMBUSTIBLE. To the person who shall discover to the Society a method of rendering muslin less combustible, to be effected by a cheaper and more effectual mode than any hitherto known; the silver medal.

Specimens of the muslin so prepared, with a full account of the process employed for the purpose, to be produced to the Society on or before the first Tuesday in February, 1809.

N. B. It is expected that the means employed should neither injure the quality, nor stain the muslin, nor damage any print or dye with which it may be coloured.

68. SUBSTANCE FOR THE BASIS OF PAINT. To the person who shall produce to the Society the best substitute, superior to any hitherto known, for the basis of paint, equally proper for the purpose as the white-lead now employed; such substitute not to be of a noxious quality, and to be afforded at a price not materially higher than that of white lead; the gold medal, or one hundred guineas.

A quantity of the substitute, not less than 50lb. weight, with an *account* of the process used in preparing it, and *certificates* that at least one hundred weight has been manufactured, to be produced to the Society on or before the first Tuesday in January, 1809.

69. RED PIGMENT. To the person who shall discover to the Society a full and satisfactory process for preparing a red pigment, fit for use in oil or water, equal in tone and brilliancy to the best carmines and lakes now known or in use, and perfectly durable; the gold medal, or thirty guineas.

One pound weight of such colour, and a full disclosure of its preparation, to be produced to the Society on or before the first Tuesday in February, 1809.

N. B. It is not required that the colour should resist the action of fire or chemical applications, but remain unaltered by the common exposure to strong light, damps, and noisome vapours.

70. ULTRAMARINE. To the person who shall prepare an artificial ultramarine, equal in colour, brilliancy, or durability, to the best prepared from lapis lazuli, and which may be afforded at a cheap rate; the gold medal, or thirty guineas.

The conditions are the same as in the preceding premium for the red pigment.

71. BLUE PIGMENT FROM IRON. To the person who shall invent, and discover to the Society, the best blue pigment from iron, superior to Antwerp or Prussian blue in colour and durability, fit for use in oil or water, which may be afforded at a cheap rate; the gold medal, or thirty guineas.

One pound weight of the colour, and a full disclosure of its preparation, to be produced to the Society on or before the first Tuesday in February, 1809.

N. B. It appears from the analysis of lapis lazuli by Klaproth, and the experiments of Gayton, (related in the Annales de Chemie) that ultramarine is a blue sulphurat of iron, and that a blue substance much resembling it is constantly found amongst the scoriæ of blast furnaces where iron is reduced, the Society by offering the above premium wishes to call the attention of persons to these facts, and encourage them to make experiments, in the hope of producing a blue pigment which may be substituted for ultramarine.

72. DESTRUCTIVE EFFECTS FROM MOTHS.

To the person who shall discover to the Society a cheap, easy, and effectual method, verified by repeated and satisfactory trials, of preventing the destructive effects occasioned by moths and other insects, in furs, woollens, and other articles, superior to any hitherto known or practised; the silver medal, or fifteen guineas.

The *accounts*, with proper *certificates*, to be produced to the Society on or before the first Tuesday in January, 1809.

73. STATUARY MARBLE. To the person who shall discover, within Great Britain or Ireland, a quarry of white marble fit for the purposes of statuary, and equal in all respects to those kinds now imported from Italy; the gold medal, or one hundred pounds.

A block of at least three feet in length, two in height, and two in width, with an account of the situation of the quarry, and *certificates* of its possessing considerable extent, to be produced to the Society on or before the first Tuesday in February, 1809.

N. B. In order to prevent useless expense or trouble to the claimant in forwarding so large a block, the Society will be ready to examine any smaller specimen of the marble, and express their opinion of its value to the candidate before the block required by the above premium is produced.

74. PREPARATION OF SULPHURIC ACID, FROM SULPHUR WITHOUT THE USE OF ANY NITRIC SALT. To the person who shall prepare the largest quantity (not less than one ton) of sulphuric acid from sulphur without any nitric salt, of a specific gravity not inferior to the best sulphuric acid of commerce; the gold medal, or fifty guineas.

Certificates that not less than the above quantity of such an acid has been prepared, together with a sample, to be produced to the Society on or before the first Tuesday in January, 1809.

75. PREPARATION OF ANY ALKALINE OR EARTHEN NITRATE. To the person who shall prepare, in Great Britain, the largest quantity, not less than one hundred weight, of any salt of nitric acid, with either earths or alkalis, by a method superior to, and as cheap as those hitherto practised; the gold medal, or one hundred guineas.

Certificates of the above quantity having been prepared, and a sample of not less than 28lb. to be produced to the Society on or before the last Tuesday in January, 1809.

76. FINE BAR IRON. To the person, in Great Britain, who shall make the greatest quantity of bar-iron, not less than ten tons, with coak, from coak pigs, equal in quality to the best iron imported from Sweden or Russia, and as fit for being converted into steel; the gold medal, or fifty guineas.

Samples, not less than one hundred weight, with *certificates* that the whole quantity is of equal quality, to be produced to the Society on or before the first Tuesday in January, 1809.

77. PRESERVING IRON FROM RUST. To the person who shall invent and discover to the Society a cheap composition, superior to any now in use, which shall effectually preserve wrought iron from rust; the gold medal, or fifty guineas.

A full description of the method of preparing the composition, with *certificates* that it has stood at least two years unimpaired, being exposed to the atmosphere during the whole time, to be produced to the Society, with ten pounds weight of the composition, on or before the first Tuesday in January, 1809.

78. REFINING BLOCK-TIN. To the person who shall discover to the Society the best method of purifying or refining block-tin, so as to render it fit for the finest purposes to which grain-tin is now applied, and not higher in price; the gold medal, or fifty guineas.

Certificates that not less than three tons have been so refined or purified, with a full detail of the process, and a quantity, not less than one hundred weight, of the tin so refined, to be produced to the Society on or before the first Tuesday in January, 1809.

79. GLAZING EARTHEN-WARE WITHOUT LEAD. To the person who shall discover to the Society the cheapest, safest, most durable, and most easily fusible composition, fit for the purpose of glazing the ordinary kinds of earthen-ware, without any preparation of lead, and superior to any hitherto in use; the gold medal, or thirty guineas.

Specimens of the ware so glazed, with proper *certificates* of its having succeeded, and a sample of the materials made use of, to be produced to the Society on or before the first Tuesday in February, 1809.

80. REFINING COPPER FROM THE ORE. To the person who shall discover to the Society the best method of separating, purifying, and refining copper from the ore, so as to render it fit for the finest purposes to which fine copper is now applied, and by a process superior to any hitherto known or in use, and not higher in price; the gold medal, or fifty guineas.

Certificates that not less than three tons have been so prepared or refined, and a quantity not less than one hundred weight of the copper so refined, to be produced to the Society on or before the first Tuesday in February, 1809.

81. MINERALOGICAL MAP OF ENGLAND AND WALES. To the person who shall complete and publish an accurate mineralogical map of England and Wales, on a scale of not less than ten miles to an inch, containing an account of the situation of the different mines therein, and describing the kinds of minerals thence produced; the gold medal, or fifty guineas.

Certificates of the accuracy of such map, together with the map, to be produced to the Society on or before the first Tuesday in

February, 1809. The map to remain the property of the Society.

82. Mineralogical Map of Ireland. The same premium is offered for a mineralogical map of Ireland, on similar conditions.

83. Mineralogical Map of Scotland. The same premium is offered for a mineralogical map of Scotland, on similar conditions.

84. Natural History. To the author who shall publish, in the year 1808, the natural history of any county in England or Wales; the gold medal, or fifty guineas.

It is required that the several natural productions, whether animal, or vegetable, or mineral, peculiar to the county, or found therein, be carefully and specifically arranged and described, in order that the public may be enabled to judge what arts or manufactures are most likely to succeed in such county. The work to be delivered to the Society on or before the last Tuesday in January, 1809.

PREMIUMS IN POLITE ARTS.

85. Honorary Premiums for Drawing, by Nobility. For the best original drawing of any kind, by young gentlemen under the age of twenty-one, sons or grandsons of peers or peeresses in their own right, of Great Britain or Ireland; the honorary medal of the Society in gold.

86. The silver medal for the best copy.

87—88. The same premiums will be given, on the like conditions, to young ladies, daughters or grand-daughters of peers or peeresses in their own right, of Great Britain or Ireland.

89. Honorary Premiums for Drawing, by Gentlemen. For the best original drawing, of any kind, by young gentlemen under the age of twenty-one; the gold medal.

90. For the best copy, the silver medal.

91—92. The same premiums will be given for drawings by young ladies.

N. B. As the foregoing honorary premiums are intended only for such of the nobility and gentry as may hereafter become patrons or patronesses of the arts; persons professing any branch of the polite arts, or any business dependent on the arts of design, or the sons or daughters of such persons, will not be admitted candidates in these classes.

93. Premiums for Drawings in General. For the best original drawing of any kind, by persons of either sex, under the age of twenty-one; the gold medal.

94. For the best copy; the silver medal.

95. Historical Drawings. For the best historical drawing, being an original composition of three or more human figures, the height of the principal figure not less than eight inches, by persons of either sex under twenty-one years of age; the gold medal.

96. For the next in merit; the silver medal.

97. Drawings of Outlines. For the best outline, after the plaster cast, of any antique statue, by persons of either sex under the age of twenty-one, the figure not less than eighteen inches; the silver medal.

98. Paintings in Oil. For the best painting in oil, of a landscape after nature, the size thirty-six by twenty-eight inches, by persons of either sex under twenty-five years of age; the gold medal.

99. For the next in merit, the silver medal. Each candidate must mention from whence the view was taken.

100. Drawing of Landscapes. For the best drawing, in water-colours, of a landscape after nature, not less than eighteen inches by twelve, by persons of either sex under twenty-one years of age; the silver medal.

101. Drawings by Engravers' Pupils. For the best finished drawing of the fighting Gladiator, from a cast the size of the original marble, the size of the drawing not less than eighteen inches, by persons under twenty-one years of age; the silver medal.

102. Engraving of Portraits. To the person who shall complete the best portrait engraved in the line manner; the gold medal.

It is required, that two impressions of the engraving be produced, and to remain the property of the Society.

103 For the next in merit; the silver medal, on similar conditions.

104. Line Engravings of Historical Subjects. For the best historical engraving of any size; the gold medal.

105. For the next in merit; the silver medal.

106. Line Engravings of Landscapes. For the best line engraving of a landscape, the gold medal.

107. For the next in merit; the silver medal.

N. B. It is not necessary, in the classes of line engravings, for the artist's name to be concealed. The first aquafortis proof is required to be sent in with two finished impressions. The aquafortis proof, and the two impressions, to remain the property of the Society.

108. Perspective Drawings of Machines. For the best perspective drawings of machines, by persons under twenty-one years of age; the silver medal.

109. Engraving on Wood or Metal Blocks, &c. For the best engraving on wood or metal blocks, of an historical subject; the size of the principal figure not less than six inches in height, and the block to be at least twelve inches by nine; the gold medal.

Two or more impressions, with the block, to be produced to the Society. The impres-

sions, but not the block, to remain the property of the Society.

110. For the next in merit; the silver medal, on similar conditions.

111. BRONZES. For the best drapery figure or group cast in bronze; if a single figure, not less than twelve inches high; and if a group, not less than nine inches; and which will require the least additional labour to repair; the gold medal, or the silver medal and twenty guineas.

The cast to be exhibited to the Society before it is begun to be repaired, with the original figure or group, together with a full explanation of the whole process.

112. MEDAL DIE ENGRAVING. For the best die engraving of one or more heads after the engraver's own model; the gold medal.

113. For the next in merit; the silver medal.

114. For the best die engraving of one figure, or a group consisting of not more than three figures, after the engraver's own model; the gold medal.

115. For the next in merit; the silver medal.

The dies, and two impressions or casts, and the model, in each claim for medal die sinking, to be produced to the Society. The impressions or casts, but not the model or die, to remain the property of the Society.

116. ARCHITECTURAL DESIGNS. For the best original design of an academy of arts, consisting of plan and elevation; the gold medallion. The drawing to remain the property of the Society.

For the next in merit; the silver medallion, on similar conditions.

The following inscription to be engraved on these medallions: *The Premium given by the Society for the Encouragement of Arts, Manufactures, and Commerce, in conformity to the Will of John Stock, of Hampstead, esq.*

117. ETCHING OF AN HISTORICAL PICTURE. For the best finished etching of an historical picture; the gold medal.

* 117. ETCHING OF A LANDSCAPE. For the best finished etching of a landscape, from a picture; the silver medal.

CONDITIONS
FOR THE POLITE ARTS.

All the claims under this class are to be produced to the Society on or before the last Tuesday in February, 1809; and no other articles in the class of Polite Arts to be admitted into the Society with a view to bounties after the last Tuesday in March.

No person who has gained the first premium in any class shall be admitted a candidate in a class of an inferior age; and no candidate shall receive more than one premium in one year.

No person shall be admitted a candidate in any class, who has already obtained the first premium in that class.

No more than one performance in any class shall be received from the same candidate.

All performances (to which premiums or bounties are adjudged) shall remain with the Society till after the first Wednesday in June, when they will be re-delivered, unless mentioned in the Premiums to the contrary.

No performance shall be admitted, that has obtained a premium, reward, or gratification, from any other society, or academy, or been offered for that purpose.

All performances that obtain premiums in the Polite Arts must have been begun after the publication of such premiums, except line engravings.

It is required, that the matters for which premiums are offered, be delivered in without names, or any intimation to whom they belong; that each particular thing be marked in what manner each claimant thinks fit, such claimant sending with it a paper sealed up, having on the outside a corresponding mark, and on the inside the claimant's name, residence, and age; which paper is not to be opened unless the candidate be successful, or by a special vote of the Society.

To encourage real merit, and prevent attempts to impose on the Society, by producing drawings made or retouched by any other person than the candidate, the Society require a specimen of the abilities of each successful candidate, under the inspection of the Committee of Polite Arts, in every instance where such proof may appear necessary.

All candidates in the Polite Arts are required to signify, on their drawings, whether the performances are originals or copies; and if copies, whence they were taken, and to mark thereon the class for which each is intended.

PREMIUMS FOR ENCOURAGING AND IMPROVING MANUFACTURES.

118. CLOTH FROM HOP-STALKS, &c. To the person who shall produce to the Society the greatest quantity, not less than 30 yards of cloth, at least 27 inches wide, made in Great Britain or Ireland, of hop-stalks or bines, or other raw vegetable substances, the produce of Great Britain or Ireland, superior to any hitherto manufactured from such substances, and which can be generally afforded as cheap as cloth of equal quality and appearance now made from hemp, flax, or cotton, and much finer in quality than any hitherto manufactured in England from hop-stalks, &c.; the gold medal, or thirty guineas.

One pound of the thread of which the cloth is made, and thirty yards of the cloth, together with proper *certificates* that the whole is manufactured from hop-stalks or bines, &c. to be produced to the Society on or before the first Tuesday in December, 1808.

N. B. The Society is already in the possession of cloth made in England from hop-stalks or bines, which may be inspected by application to the Housekeeper.

* 118. HOGS' BRISTLES. To the person who shall prepare the greatest quantity of bristles, from swine bred in the united kingdoms, equal in quality to those imported from Russia or Prussia, and at as cheap a rate; the silver medal, or fifteen guineas.

Certificates, that not less than one hundred weight have been so prepared, and a sample of not less than fourteen pounds of such bristles, to be produced to the Society on or before the last Tuesday in February, 1809.

119. WICKS FOR CANDLES OR LAMPS. To the person who shall discover to the Society a method of manufacturing hop-stalks or bines, or any other cheap material, the growth of Great Britain, so as to render them equally fit for the purpose of supplying the place of cotton, for wicks of candles or lamps; twenty guineas.

Samples, not less than five pounds weight, of the wick so prepared, to be produced to the Society on or before the last Tuesday in December, 1808, with *certificates* that the whole quantity is equal in quality to the sample.

120. EXPERIMENTS TO ASCERTAIN THE PROPER THICKNESS OF WICKS FOR CANDLES. To the person who shall make known to the Society the most satisfactory result of a series of experiments, actually made by him to determine the best thickness of cotton wicks for candles, so as to obviate the defects of those commonly used; the silver medal, or ten guineas.

Certificates, that not less than one hundred weight have been so made, and six pounds of the candles, to be produced to the Society on or before the last Tuesday in February, 1809.

N. B. The intention in offering this premium, is to ascertain the proper thickness or bulk of the wick in proportion to that of the tallow, and to remove the unpleasant consequences and waste arising from the sparkling, or guttering of the candles in common use.

121. PAPER FROM RAW VEGETABLE SUBSTANCES. To the person in Great Britain, or Ireland, who shall, between the first of January, 1808, and the first of January, 1809, make the greatest quantity, and of the best quality, (not less than ten reams) of good and useful paper, from raw vegetable substances, the produce of Great Britain or Ireland, of which one hundred weight has not been used in manufacturing paper previous to January, 1807, superior to any hitherto manufactured from such substances, and which can be generally afforded as cheap as paper of equal quality and appearance now made from rags; twenty guineas.

N. B. The object of the Society being to add to the number and quantity of raw materials used in this manufacture, it is their wish to include every useful sort of paper, and to introduce such natural products as can be easily and cheaply procured in great quantities. The Society are in possession of two volumes containing a great variety of specimens of paper made from raw vegetable substances, viz. nettles, potatoe-haulm, poplar, hop-bines, &c. which volumes may be inspected by any person on application to the Housekeeper.

Certificates of the making such paper, and one ream of the paper, to be produced on or before the second Tuesday in January, 1809.

122. TRANSPARENT PAPER. To the person who shall discover to the Society a method of making paper from the pulp, that shall be perfectly transparent, and of a substance and body equal to foolscap, that shall take and bear common writing ink with the same facility and correctness as writing-paper generally in use; the silver medal, or twenty guineas.

Certificates of the making such paper, an *account* of the process, and one ream of the paper, to be produced on or before the second Tuesday in January, 1809.

123. CHINTS PATTERNS FOR CALICO-PRINTERS. For the best original pattern in a new taste, of light or dark-ground chintz for garment-work, or furniture, fit for the purposes of calico-printers, by persons of either sex; the gold medal. The pattern for which the premium is adjudged to remain the property of the Society.

124. For the next in merit; the silver medal, on similar conditions.

125. COPPER-PLATE PATTERNS FOR CALICO-PRINTERS. For the best pattern, in a new style, fit for the purposes of calico-printers for garment work, or furniture; the silver medal. The pattern for which the premium is adjudged to remain the property of the Society.

N. B. The patterns to be produced on or before the last Tuesday in February, 1809.

PREMIUMS IN MECHANICS.

126. GUNPOWDER-MILLS. To the person who, in the year 1808, shall invent and bring to perfection the most effectual method of so conducting the works of gunpowder-mills, in the business of making gunpowder, as to prevent explosion; the gold medal, or one hundred guineas.

Certificates and *accounts* of the method having been put in practice in one or more gunpowder-mills in this kingdom, and that it promises, in the opinion of the best judges concerned in such works, to answer the purpose intended, to be produced to the Society on or before the first Tuesday in February, 1809.

N. B. As an encouragement to persons to turn their thoughts to improvements of this nature, if any should be made on the present method of conducting the business of gunpowder making, which fall short of the total prevention of explosion, and they are sent to the Society for the sake of humanity, the papers so sent in will receive due consideration, and such bounty or reward will be bestowed as they may appear to merit.

127. TRANSIT INSTRUMENT. To the person who shall invent and produce to the Society a cheap and portable transit-instrument which may easily be converted into a zenith-sector, capable of being accurately and expeditiously adjusted for the purpose of finding the latitudes and longitudes of places, and superior to any portable transit-instrument now in use; the gold medal, or forty guineas.

To be produced on or before the last Tuesday in January, 1809.

128. TAKING WHALES BY THE GUN-HARPOON. To the person who, in the year 1808, shall strike the greatest number of whales, not fewer than three, with the gun-harpoon; ten guineas.

Certificates of the striking such whales, and that they were actually taken in the year 1808, signed by the master, or by the mate, when the claim is made by the master, to be produced to the Society on or before the last Tuesday in December, 1808.

129. FAMILY-MILL. To the person who shall invent and produce to the Society the best-constructed mill for grinding corn for the use of private families, or parish-poor; the construction to be such as to render the working of the mill easy and expeditious, and superior to any hitherto in use; the gold medal, or thirty guineas.

The mill, and *certificates* of its having been used to good effect, to be produced to the Society on or before the first Tuesday in February, 1809. Cheapness and simplicity will be considered as essential parts of its merit; and the mill or a model, to remain with the Society.

130. MACHINE FOR RAISING COALS, ORE, &c. &c. To the person who shall invent a machine for raising coals, ore, &c. from mines, superior to any hitherto known or in use; and which shall produce the effect at a less expense than those already known, or in use; the gold medal, or fifty guineas.

A model of the machine, made on a scale of not less than one inch to a foot, with a *certificate* that a machine at large on the same construction has been advantageously used, to be produced to the same Society on or before the second Tuesday in February, 1809.

131. IMPROVED WALKING-WHEEL, OR CRANE. To the person who shall invent an improved walking-wheel or crane, on which the weight and power of any person or persons shall be applied with the greatest safety and effect, and so contrived that the power can be varied according to the greater or less weight to be raised or lowered; the gold medal, or thirty guineas.

The model, on a scale of not less than one inch to a foot, with a proper *certificate* that the machine at large has been employed to good effect, to be produced to the Society on or before the second Tuesday in February, 1809.

132. MACHINE FOR RAISING WATER. To the person who shall invent a machine on a better, cheaper, and more simple construction than any hitherto known or in use for raising water out of wells, &c. from a depth of not less than fifty feet; the gold medal, or thirty guineas.

Certificates of the performance of the machine, and a model of it, on a scale of not less than one inch to a foot, to be produced to the Society on or before the first Tuesday in February, 1809.

133. ELM PIPES. To the person who shall invent and discover to the Society a substitute for the elm pipes now in common use for the conveyance of water, which shall be cheaper, equally effectual, and more durable than any heretofore employed; the gold medal, or thirty guineas.

It is required that one of the pipes so employed, an accurate *account* of the method used, and every expense attending it, together with satisfactory accounts of its being effectual, be delivered to the Society on or before the second Tuesday in January, 1809.

134. LAYING WOODEN PIPES. To the person who shall invent and discover to the Society a superior method of laying or connecting the wooden pipes now in use for conveying water, so as to lessen the injury they receive thereby; the silver medal, or fifteen guineas.

It is required that a model, an accurate *account* of the method used, and every expense attending it, together with satisfactory *certificates* of its being effectual, be delivered to the Society, on or before the second Tuesday in January, 1809.

135. EXTINGUISHING FIRES. To the person who shall produce to the Society the best and most effectual method of procuring an immediate supply of water in case of fire, or for the means best calculated to prevent or extinguish accidental fires in buildings, superior to any now in use; the gold medal, or thirty guineas.

Certificates of the method having been practised with success, with a full description thereof, to be delivered to the Society on or before the second Tuesday in January, 1809.

136. BORING AND BLASTING ROCKS. To the person who shall discover to the Society a more simple, safe, cheap, and expeditious method than any hitherto known

or in use, of boring or blasting rocks in mines, shafts, wells, &c.; the gold medal, or thirty guineas.

Certificates of the method having been practised with success, with a full description thereof, to be delivered to the Society on or before the first Tuesday in January, 1809.

137. Heating Rooms for the Purpose of Manufacturers. To the person who shall invent and discover to the Society a method of heating rooms, superior to any hitherto known or in use, and at a moderate expense, for the purpose of painters, japanners, and other manufacturers, so as to avoid the necessity of iron or copper tunnels going through the rooms to convey the smoke, whereby the danger from such tunnels may be prevented; the gold medal, or forty guineas.

A model or complete drawing and description of the method, with *certificates* that it has been successfully practised, to be delivered to the Society on or before the last Tuesday in March, 1809.

138. Improved Ventilation. To the person who shall invent and produce to the Society a mode of permanently ventilating the apartments in hospitals, workhouses, and other crowded places, superior to any now known or used; the gold medal, or fifty guineas.

A model of the apparatus, and a full *account* of the means by which the effect has been produced, with proper *certificates*, to be delivered to the Society on or before the last Tuesday in February, 1809.

139. Preventing Accidents from Horses falling with two-wheeled Carriages. To the person who shall invent and produce to the Society a method, superior to any hitherto known or in use, to prevent accidents from the falling of horses with two-wheeled carriages, especially on steep declivities; the silver medal, or fifteen guineas.

A model of the apparatus, and a full *account* of the means by which the effect has been produced, with proper *certificates* that the same has been used with success, to be delivered to the Society on or before the second Tuesday in January, 1809.

140. Improving Turnpike and other Roads. To the person who shall discover to the Society the most effectual and cheapest method, verified by actual experiments, of combining the materials ordinarily employed in making or repairing roads, so as to form them of the hardest consistency by their cementing properties, or by an artificial mixture of earth, stones, &c. altered by heat or any other mode, so as to form an even, hard, and durable carriage-road, not liable to be injured by heat or rain; the gold medal, or thirty guineas.

It is required that an accurate *account* of the method used, and every expense attending it, together with satisfactory *certificates* of its being effectual, be delivered to the Society on or before the first Tuesday in March, 1809.

141. Raising the Bodies of Persons who have sunk under Water. To the person who shall invent and produce to the Society a cheap and portable drag, or other machine, superior to those now in use, for the purpose of taking up, in the best and most expeditious manner, and with the least injury, the bodies of persons who have sunk under water; the gold medal, or thirty guineas.

The drag, or machine to answer the purpose intended, to be produced to the Society on or before the first Tuesday in March, 1809.

142. For preventing prejudicial Effects to the Persons employed in Pointing Needles. To the person who shall invent and produce to the Society a mode of obviating the prejudicial effects that attend the operation of pointing needles, by grinding them dry, during which the particles of grindstone, dust, and steel, being thrown into the air, and received with it into the lungs, occasion asthma, consumption, and other painful disorders; the gold medal, or thirty guineas.

A model of the apparatus, and a full *account* of the means by which the effect has been produced, together with proper *certificates* of its practicability and adoption, to be delivered to the Society on or before the second Tuesday in March, 1809.

PREMIUMS OFFERED FOR THE ADVANTAGE OF THE COMMERCE OF THE UNITED EMPIRE.

143. Taking Porpoises. To the people in any boat or vessel, who, in the year 1808, shall take the greatest number of porpoises on the coast of Great Britain or Ireland, by gun, harpoon, or any other method, not fewer than thirty, for the purpose of extracting oil from them; the gold medal, or thirty pounds.

Certificates of the number, signed by the persons to whom they have been sold or delivered for the purpose of extracting the oil, to be produced to the Society on or before the last Tuesday in January, 1809.

144. Oil from Porpoises. To the person who shall manufacture the greatest quantity of oil from porpoises taken on the coast of Great Britain or Ireland, in the year 1807, not less than twenty tons; the gold medal, or thirty pounds.

Certificates of the oil having been made from porpoises actually caught on the coast of Great Britain or Ireland, and two gallons of the oil as a sample, to be produced to

the Society on or before the last Tuesday in February, 1809.

145. Curing Herrings by the Dutch Method. To the person or persons who shall, before January 1809, cure the greatest quantity of white herrings, not less than thirty barrels, according to the method practised by the Dutch, and equal in all respects to the best Dutch herrings, the same being caught in the British or Irish seas, and cured in a British or Irish vessel or port; the gold medal, or fifty guineas.

146. For the next greatest quantity, not less than fifteen barrels; the silver medal, or twenty guineas.

A sixteen-gallon barrel of the herrings to be produced to the Society on or before the first Tuesday in February, 1809, with *Certificates*, that the conditions of the premium have been fulfilled, and that the whole were cured in the same manner as the specimen, together with a full description of the process employed, in order that the Society may judge how far the Dutch method has been adopted.

147, 148. The same premiums are extended one year farther. *Certificates* to be produced on or before the first Tuesday in February, 1810.

PREMIUMS OFFERED FOR THE ADVANTAGE OF THE BRITISH COLONIES.

149. Nutmegs. For the greatest quantity of merchantable nutmegs, not less than ten pounds weight, being the growth of his Majesty's dominions in the West Indies, or any of the British settlements on the coast of Africa, or the several islands adjacent thereto, and equal to those imported from the islands of the East Indies; the gold medal, or fifty guineas.

Satisfactory *certificates*, from the governor, or commander in chief, of the place of growth, with an *account* of the number of trees, their age, nearly the quantity of fruit on each tree, and the manner of culture, to be produced on or before the first Tuesday in December, 1808.

150. The same premium is extended one year farther.

Certificates to be produced on or before the first Tuesday in December, 1809.

151. Kali for Barilla. To the person who shall have cultivated, in the Bahama Islands, or any other part of his Majesty's dominions in the West Indies, or any of the British settlements on the coast of Africa, or the several islands adjacent thereto, in the year 1807, the greatest quantity of land, not less than two acres, with Spanish kali fit for the purpose of making barilla; the gold medal, or thirty guineas.

152. For the next greatest quantity, not less than one acre; the silver medal, or fifteen guineas.

Certificates, signed by the governor or commander in chief for the time being, of the quantity of land so cultivated, and of the state of the plants at the time of signing such *certificates*, to be delivered to the Society, with samples of the kali, on or before the second Tuesday in January, 1809.

153. The same premiums are extended one year farther.

Certificates to be produced on or before the second Tuesday in January, 1810.

154. Destroying the Insect commonly called the Borer. To the person who shall discover to the Society an effectual method of destroying the insect commonly called the Borer, which has of late years been so destructive to the sugar-canes in the West-India islands, the British settlements on the coast of Africa, and the several islands adjacent thereto; the gold medal, or fifty guineas.

The discovery to be ascertained by satisfactory *certificates*, under the hand and seal of the governor or commander in chief for the time being, and of some other respectable persons, inhabitants of the islands, or other place, in which the remedy has been successfully applied; such *certificates* to be delivered to the Society on or before the first Tuesday in January, 1809.

155. The same premium is extended one year farther.

Certificates to be produced on or before the first Tuesday in January, 1810.

156. Cultivation of Hemp in Upper or Lower Canada. To the person who shall sow with hemp, the greatest quantity of land in the province of Upper Canada, not less than six arpents, (each four-fifths of a statute acre) in the year 1808, and shall at the proper season cause to be plucked the summer hemp, or male hemp bearing no seed, and continue the winter hemp, or female hemp bearing seed, on the ground until the seed is ripe; the gold medal, or one hundred dollars.

157. To the person who shall sow with hemp the next greatest quantity of land in the same province of Upper Canada, not less than five arpents in the year 1808, in the manner above mentioned; the silver medal, or eighty dollars.

158. For the next greatest quantity of land, in the same province, and in a similar manner, not less than four arpents; sixty dollars.

159. For the next greatest quantity of land, in the same province, and in a similar manner, not less than three arpents; forty dollars.

160. For the next greatest quantity of land, in the same province, and in the same manner, not less than one arpent; twenty dollars.

Certificates of the number of arpents, the method of culture, of the plucking of the hemp, with a general *account* whether sown

broad-cast or in drills, the expense, soil, cultivation, and produce, to be transmitted to the Society, certified under the hand and seal of the governor or lieutenant-governor, together with 28lb. of the hemp, and two quarts of the seed, on or before the last Tuesday in November, 1809.

161 to 165. Premiums exactly similar in all respects to those held out for the province of Upper Canada, are also offered for the province of Lower Canada, and are extended to the same period.

166. IMPORTATION OF HEMP FROM CANADA. To the master of that vessel which shall bring to this country the greatest quantity of marketable hemp, not less than one hundred tons, in the year 1808, the produce of Upper or Lower Canada; the gold medal.

167. To the master of that vessel which shall bring the next quantity, not less than fifty tons; the silver medal.

Certificates satisfactory to the Society, to be produced by the master of the vessel on or before the first Tuesday in February, 1809, to testify that such hemp was grown and prepared in Canada.

168. SUBSTITUTE FOR HEMP. To the person who, in the year 1808, shall discover and produce to the Society a substitute for hemp, equally cheap, durable, and applicable to all the purposes for which hemp is now used; the gold medal, or fifty guineas.

A quantity of the substitute, not less than one hundred weight, together with proper *certificates* from the governor or commander in chief, if raised in any of the British colonies, or from the Secretary of the Board of Trade, if raised in the East Indies, to prove that the same has been used with success, to be produced to the Society on or before the last Tuesday in February, 1809.

169. The same premium is extended one year farther.

Certificates to be produced on or before the last Tuesday in February, 1810.

PREMIUMS OFFERED FOR THE ADVANTAGE OF THE BRITISH SETTLEMENTS IN THE EAST INDIES.

170. BHAUGULPORE COTTON. To the person who shall import into the port of London, in the year 1808, the greatest quantity, not less than one ton, of the Bhaugulpore cotton, from which cloths are made in imitation of nankeen, without dying; the gold medal.

A quantity of the cotton, not less than five pounds weight, in the pod, and five pounds carded, to be produced to the Society, with proper *certificates*, signed by the Secretary to the Board of Trade of Bengal or Bombay, on or before the last Tuesday in February, 1809.

171, 172. The same premium is extended two years farther.

Certificates to be produced at the same time of the years ensuing.

173. ANNATTO. To the person who, in the year 1808, shall import into the port of London, from any part of the British settlements in the East Indies, the greatest quantity of annatto, not less than five hundred weight; the gold medal.

A quantity of the annatto, not less than ten pounds weight, to be produced to the Society, with proper *certificates*, signed by the Secretary of the Board of Trade of the respective settlement, that the annatto is the produce of such settlement, on or before the last Tuesday in February, 1809.

174, 175. The same premium is extended two years farther.

Certificates to be produced at the same time of the years ensuing.

176. TRUE COCHINEAL. To the person who, in the year 1808, shall import into the port of London, from any part of the British settlements in the East Indies, the greatest quantity of true cochineal, not less than five hundred weight; the gold medal.

A quantity of the cochineal, not less than ten pounds weight, with proper *certificates*, signed by the Secretary of the Board of Trade of the respective settlement, that the cochineal is the produce of such settlement, to be produced to the Society on or before the first Tuesday in February, 1809.

177, 178. The same premium is extended two years farther.

Certificates to be produced at the same time of the years ensuing.

GENERAL CONDITIONS.

As the great object of the Society in rewarding individuals is to draw forth and give currency to those inventions and improvements, which are likely to benefit the public at large, candidates are requested to observe, that if the *means*, by which the respective objects are effected, do require an expense or trouble too great for *general purposes*, the Society will not consider itself as bound to give the offered *reward*; but, though it thus reserves the power of giving in all cases such part only of any premium as the performance shall be adjudged to deserve, or of withholding the whole if there be no merit, yet the candidates may be assured the Society will always judge liberally of their several claims.

All candidates are to take notice, that no claim for a premium will be attended to, unless the conditions of the advertisement are fully complied with.

All models of machines, which obtain premiums or bounties, shall be the property of the Society; and, where a premium or bounty is given for any machine, a perfect model and description thereof shall be given to the Society.

All the premiums of this Society are designed for Great Britain and Ireland, unless expressly mentioned to the contrary.

The claims shall be determined as soon as possible after the delivery of the specimens.

It is expected that all articles for claims or bounties be sent to the Society, carriage paid.

No person shall receive any premium, bounty, or encouragement, from the Society, for any matter for which he has obtained, or purposes to obtain, a patent, or for which he has obtained, or expects any premium or reward from any other Society.

A candidate for a premium, or a person applying for a bounty, being detected in any disingenuous method to impose on the Society, shall forfeit such bounty, and be deemed incapable of obtaining any for the future.

No member of this Society shall be a candidate for, or entitled to receive, any premium, bounty, or reward whatsoever, except the honorary medal of the Society. The candidates are, in all cases, expected to furnish a particular account of the subject of their claims; and where certificates are required to be produced in claim of premiums, they should be expressed, as nearly as possible, in the words of the respective advertisements, and be signed by persons who have a positive knowledge of the facts stated.

Where premiums or bounties are obtained in consequence of specimens produced, the Society mean to retain such part of those specimens as they may judge necessary, making a reasonable allowance for the same.

No candidate, not a member, shall be present at any meetings of the Society or committees, or admitted at the Society's rooms, after they have delivered in their claims, until such claims are adjudged, unless summoned by the Committee.

The Society, anxious to promote the Arts of their country, have adopted the resolution of forming a Collection of Prints, to be open for public inspection; and, having arranged those already in their possession, invite engravers to send etched or finished proofs of their plates: and hope that amateurs, collectors, and publishers of works of art, will also contribute to the undertaking.

Prints of machines, or maps, will also come within the above arrangement.

The Society farther invite the communications of scientific and practical men, upon all subjects connected with the views of the Society, although their experiments may have been conducted upon a smaller scale than the terms required by the premiums; as such communications may afford ground for more extensive application, and thus materially contribute to the advantage of the public.

The Library of the Society, which has already become very valuable, may yet receive considerable additions and improvements from the presents of members, or other persons who may be inclined to place useful books or valuable manuscripts in a repository, at once permanent and conducive to the national benefit.

All communications are to be made by letter, addressed to Dr. CHARLES TAYLOR, the Secretary, *at the Society of Arts, &c. Adelphi, London.*

The Winchester bushel is the measure referred to for grain; and, as the acres of different districts vary in extent, it is necessary to observe, that the Society mean Statute Acres of five and a half yards to the rod or pole, when acres are mentioned in their list of premiums; and they request that all communications to them may be made agreeably thereto.

The Society desire that the Papers on different subjects sent to them may be full, clear, explicit, fit for publication, and rather in the form of Essays than of Letters; and that descriptive Drawings may be sent, with the Models and Machines laid before the Society.

*** To persons inclined to leave a sum of money to this Society by will, the following form is offered for that purpose.

Item. I give and bequeath to A. B. and C. D. the sum of upon condition and to the intent that they, or one of them, do pay the same to the Collector, for the time being, of a Society in London, who now call themselves the Society for the Encouragement of Arts, Manufactures, and Commerce; which said sum of I will and desire may be paid out of my personal estate, and applied towards the carrying on the laudable designs of the Society.

N. B. The Society considering that it would be beneficial to the Commerce of the United Kingdom to bring the British Marbles into more general use, and that the most effectual method of accomplishing their object would be, for the present, *to make them more generally known in the capital, have come to the following resolutions:—*

Resolved,—That specimens of British Marbles be exposed in the Society's Rooms at the Adelphi, for the inspection of the public, under the following regulations:

1st, That all specimens be exact to a given size, *viz.* eight inches high, six inches broad, one inch thick, and polished on one face.

2d, That a book be kept, containing the number of each specimen, and describing the situation of the quarry, the name of the parish where situated, the distance of the quarry from a beaten road, and the distance of that road from water-carriage, with the name of the donor and proprietor. Any remarks on the qualities of the marbles, or on the lime produced from them, will be gratefully received and preserved by the Society, as materials for future inquiries.

Resolved,—That as the exertions of the Society can be beneficial to the public, only inasmuch as their views are seconded by the public, the Society request, that all persons, proprietors of marble quarries, will favour them with a specimen of the marble, worked to the exact size above mentioned, with the description of the quarry as above, that the same may be entered in the book to be preserved for the use of the public.

Premiums and Rewards bestowed in May, 1808, *by the Society of Arts, Manufactures, and Commerce, Adelphi.*

ON Tuesday the 31st of May, 1808, the Rewards of the Society were, as usual, distributed by his Grace the Duke of Norfolk, arranged under the following classes; and on Wednesday the 1st of June, the Society held the last Meeting of that Session, and adjourned to the fourth Wednesday in October next.

IN AGRICULTURE.

To John Christian Curwen, Esq. M. P. of Workington Hall, Cumberland, for improvements in the culture of vegetables, the gold medal.

To the Right Hon. the Earl of Mansfield, for planting 96,000 Oaks at Scone, near Perth, class 3; the gold medal.

To the Right Hon. Lord Boringdon, for gaining land from the sea, at Chelsea Bay, near Plympton, and at Charlton, near Kingsbridge, class 17, the gold medal.

To the Right Reverend Lord Bishop of Llandaff, for planting 322,500 larch trees, near Newby Bridge, Lancashire, class 10, the gold medal.

To A. Bain, M. D. of Curzon Street, for planting 338,199 forest trees, at Heffleton, in Dorsetshire, class 14, the gold medal.

To Robert Burrows, Esq. of Great Witchingham, Norfolk, for comparative culture of wheat, class 17, the gold medal.

To Mr. Charles Waistell, of High Holborn, for his communication of methods to ascertain the value of growing timber trees, at different and distant periods, the gold medal.

To J. Butler, Esq. Bramshott, Hants, for improving waste land, the silver medal.

To William Lawrence, Esq. of Maldon, Essex, for gaining land from the sea, the silver medal.

To Mr. Samuel Curtis, Walworth, for planting above 4,000 fruit trees, for an orchard at Bradwell, in Essex, the silver medal.

To Mr. Richard Parkinson, Walworth, near London, for cure of the foot-rot in sheep, class 49, the silver medal.

To Mr. W. Wallis Mason, Goodrest Lodge, near Warwick, for a method of stabbing hoven cattle, to discharge the rarified air from the stomach when they have been over-fed with moist clover grass, the silver medal.

To Mr. Timothy Fisher, Ormskirk, Lancashire, for a swivel-headed churn staff, to facilitate the making of butter; five guineas.

IN CHYMISTRY.

To Mr. William Anderson, of his Majesty's dock-yard, Portsmouth, for a method of painting linen cloth in oil colours, to be more pliant, durable, and longer impervious to water, than in the usual mode, the silver medal.

To Mr. Thomas Saddington, No. 78, Lower Thames Street, for a cheap method of preserving fruit without sugar for house use, or sea stores, five guineas.

IN POLITE ARTS.

To Mr. Samuel Wharton, Neat-Houses, Chelsea, for an original drawing of ornamental Architecture, the silver medal.

To Mr. Henry Parke, Dean Street, Soho, for a drawing of a sea piece, class 90; the silver medal.

To Mr. D. Dighton, Charing Cross, for an original drawing of the battle of King Richard and Saladin, the silver medal.

To Miss Aspinall, Quality Court, Chancery Lane, for a Drawing of the Death of Virginia, the silver medal.

To Mrs Coppins, St. Stephens, Norwich, for the copy of an oil painting after Teniers, the silver medal.

To Miss Charlotte Delattre, North End, Fulham, for a drawing of the Grecian Daughter nourishing her father, the silver medal.

To Mr. Philip Rogers, Great Pulteney Street, for an original oil painting of a landscape, the silver medal.

To Mr. W. Finden, Warren Street, Fitzroy Square, for a drawing of the Gladiator, class 101, the silver medal.

To Mr. William Thomas, Upper Charlotte Street, Fitzroy Square, for a drawing of St. Augustin preaching in Britain, the smaller silver pallet.

To Miss Barron, Carmarthen Street, Tottenham Court Road, for a drawing of the aloe plant from nature, the silver medal.

To Miss Eliza Hamilton, James Street, Buckingham Gate, for a drawing of red deer, class 92, the silver medal.

To Miss Mary Watts, Portland Place, for a drawing of a landscape after Both, the silver medal.

To Mr. E. Hodges Baily, Upper Cleveland Street, for a plaster cast of the Laacoon, the silver medal.

To Mr. Joseph Gott, Upper Norton Street, for an original plaster cast of Sampson slaying the Philistines, the greater silver pallet.

To Mr. W. Woolnoth, Gloucester Place, Camden Town, for a line engraving of Tickenote Church, in Rutlandshire, the larger silver pallet.

To Miss Elizabeth Ann Barlow, of Somerset Place, for a drawing of a landscape, the smaller silver pallet.

To Miss Mary Okes, of Cambridge, for a drawing from a design for a gothic hall, the smaller silver pallet.

To Miss Eliza Dinwiddie, Titchfield Street, for a drawing of the island of Capri, the smaller silver pallet.

To Mr. J. C. Bromley, Brook Green, Hammersmith, for an etching of cattle, the smaller silver pallet.

To Master William Ross, Tavistock Street, Covent Garden, for an original drawing of the Judgment of Solomon, the silver medal.

To Miss Mary Ann Barron, Carmarthen Street, Tottenham Court Road, for a drawing from a scene in the play of Titus Andronicus, the smaller silver pallet.

To Miss Mary Williams, for an oil painting of St. Girolamo, after a copy from Corregio, the greater silver pallet.

To Mrs. Emma Jane Hooker, of Rotting Dean, near Brighton, for an encaustic painting, in imitation of the ancient Grecian manner, the silver medal.

IN MANUFACTURES.

To George Whitworth, Esq. of Coxwold, near Castor, Lincolnshire, for his exertions in manufacturing ropes and sacking from sheep's wool, to answer the purpose of similar articles made from hemp, the gold medal.

To Mr. Peter Tansley, of Wheeler Street, Spital-fields, for a cheaper method of cutting silk shag, five guineas.

IN MECHANICS.

To Captain George William Manby, of Yarmouth, for forming a communication with ships stranded, by means of a rope thrown over the vessel from a mortar on the shore, the gold medal.

To Captain Wm. Bolton, R. N. for improved jury masts, formed from the common articles on board ships, and on a plan to enable them to carry the usual press of sail, the silver medal.

To Captain H. L. Ball, R. N. of Mitcham, in Surrey, for an improvement in anchor stocks, to render them more durable and safe for ships, the silver medal.

To Mr. Thomas Roberts, of the Navy Office, for improvements in ship building, by securing the ends of the beams of ships without wooden knees, the silver medal.

To Major Charles le Hardy, of the isle of Jersey, for a telegraph of a new construction, referring to any number of words under forty thousand, the silver medal.

To the Chevalier Edelcrantz, of Stockholm, for his model of the telegraph used in Sweden for conveying intelligence, the silver medal.

To Mr. Henry Ward, of Blandford, Dorsetshire, for an ingenious crank in working telegraphs, ten guineas.

To Mr. Robert Richardson, of Keswick, in Westmoreland, for an easy and simple method of raising large stones out of the earth, ten guineas.

To Mr. William Barlow, of the dock-yard, Portsmouth, for a screw wrench to fit different sized heads of screws, five guineas.

To Mr. John Tad, Little Hermitage-street, Wapping, for a method of preventing doors from dragging on carpets, five guineas.

COLONIES AND TRADE.

To George Errington, Esq. of Yarmouth, for his improvements in the cure of white herrings, resembling the Dutch pickled herrings, the silver medal.

To Mr. Ezekiel Cleall, of West Coker, near Yeovil, Somersetshire, for a machine for thrashing out hemp seed and flax seed, recommended for use in Canada, to preserve the seed in a better state for vegetation, twenty guineas.

The number of Members elected since October, 1807, *is* 116.

The List of Premiums offered may be had, *gratis*, at the Society's House in the Adelphi;

By Order of the Society,

June, 1808. CHARLES TAYLOR, M. D. Secretary.

C. WHITTINGHAM, Printer, Goswell Street.

COMMUNICATIONS

IN THE

SEVERAL DEPARTMENTS

OF

AGRICULTURE,

CHEMISTRY,

MANUFACTURES,

MECHANICS,

AND

COLONIES AND TRADE.

PAPERS

IN

AGRICULTURE.

The GOLD MEDAL *of the Society being the Premium offered for planting* OAKS, *was this Session adjudged to the Right Hon. the* EARL OF MANSFIELD, *from whom the following Communications were received.*

SIR,

ON behalf of Lord Mansfield, as a candidate for a premium for raising oaks, since the year 1803, I beg leave through you to submit the following statement to the Society of Arts, &c. viz.

That since the year 1803, I have raised and lanted for the Earl of Mansfield at Scone, near Perth, Perthshire, 96,000 oaks, part of them raised from acorns in his lordship's nursery, and part from young plants; the whole of them are properly fenced with hedge and ditch, and where that was impracticable, with strong paling. Part of the ground planted consists of steep banks on the side of a brook, and the river Tay, the remaining part common moor—the

banks were made and planted in the common way—the moor was planted after a different manner: the whins, or furze, with which it was partly covered, were burnt, and the land ploughed as well as the nature of it would admit, (being very rough and stony,) in the autumn 1804, and summer 1805, and before planting laid up in ridges of four feet breadth, which, with some open drains cut through them, laid the whole completely dry, and the oaks were put in on the top of the ridges.

The above treatment was suggested to me by Lord Mansfield, and is, I believe, a new mode, which has met with the approbation of every one who has seen it, as it lays the land dry, and prevents the young plants being thrown out by the frost in winter, to which, by the nature of the soil and climate here, they are very liable to. It lays a greater quantity of surface mould round them, in which they grow freely while young, and although a bad soil, the whole are in a more healthy and thriving state than other plantations near them; as the following certificate from experienced and respectable nurserymen and gardeners will show, who have viewed the whole, in order to certify the state they are in, agreeable to the Rules of the Society.

Any further statement or explanation deemed necessary will be readily furnished by addressing a line to me, gardener to the Earl of Mansfield at Scone near Perth.

I am, Sir,

Your most obedient servant,

WILLIAM BEATTIE.

Scone Gardens, 18th Dec. 1807.

To C. Taylor, M. D.

Secretary to the Society of Arts, &c.

Certificate

Certificate of the Truth of the foregoing Statement.

We the undersigned having viewed the plantations referred to in the foregoing report, do hereby certify that they are in a healthy and thriving state, (in particular those on the common moor,) that there is at least 500 plants per acre in that state, and the whole are fenced as represented.

John Burton, *late Gardener to Earl Ferrers.*
Robert Brown, Nurseryman, Perth.
James Brown, ditto.

A Certificate to the same effect, was likewise received by the Society, signed by the Rev. William Aitkin, Minister of the Parish of Scone.

The Gold Medal *of the Society being the Premium offered for planting* Larches, *was this Session adjudged to the Right Rev. the* Lord Bishop of Landaff, *for planting* 322,500 Larch Trees, *near Newby Bridge, Lancashire, from whom the following Accounts and Certificates were received.*

SIR,

In 1789, I was honoured by the Society with a Gold Medal, for having planted forty-eight thousand larches on a high barren mountain, called Wansfel, near Ambleside. This was the first plantation which had been made in this

country on such an exposed situation, and I was told by every body that it would never thrive. I have great pleasure therefore in assuring the Society that it flourishes beyond my expectation. The trees on an average now measuring above eleven inches in circumference, at six feet from the ground.

I herewith transmit to you a certificate of my having planted on two contiguous mountains, called Birkfell and Gomershow, situated near the foot of Winandermere, three hundred and twenty-two thousand five hundred larches; and a certificate also signed by two most respectable gentlemen of the present state of the two plantations. I do not know the exact height of either of these mountains, but Gomershow is seen at a great distance in every direction, above the rest of the mountains on the borders of the lake, and the surface of the lake is more than one hundred feet above the level of the tide at high water.

I have some expectation of coming into possession of a large portion of land on the top of Skiddaw, a mountain near Keswick, one thousand and ninety yards in height; and if I should succeed in this expectation, it is my intention to plant it with larches, that I may leave to posterity either a convincing proof that in this climate the larch tree will flourish on the highest mountains in Great Britain, or a mark of my folly, to warn others from attempting to render land so situated beneficial to the state, and to themselves, by planting it.

Many men are deterred from planting by an apprehension of the expense attending the requisite fencing, but this expense is not great when a plantation is large, and the fence is situated on the acclivity of a hill, for the rise of the hill will very much reduce the height of the wall, especially

cially if the earth be hollowed out three feet in breadth, a foot in depth, and at a foot and one-half distance from the wall.

A square mile of fence incloses six hundred and forty statute acres, and the same extent of fence (7040 yards) will inclose a circle containing eight hundred and fourteen acres, and may in most countries be made at less than sixpence a yard, lineal measure, or little more than four shillings an acre for 814 acres; and the areas of similar figures being as the squares of their homologous sides, a circular fence of double the extent here mentioned would inclose four times 814 acres.

With my best wishes for the prosperity of a Society which has in various ways rendered great service to the community,

I am, Sir,

Your faithful Servant,

R. LANDAFF.

Calgurth Park, Kendall,
October 17, 1807.

To C. TAYLOR, M. D. SEC.

I, ROBERT ATKINSON, do hereby certify, that between the 27th day of Nov. 1804, and 6th day of April 1805, I planted with proper assistance for the Bishop of Landaff, one hundred and twenty-two thousand five hundred larches, on a mountain called Birkfell, situated near Newby-bridge, in the parish of Cartmel, and county of Lancaster. And I do hereby further certify, that between November 1805 and the 25th of March 1806, I planted for the said Bishop on

a mountain called Gomershow, adjoining to Birkfell, two hundred thousand larches. The larches of both plantations had been transplanted one or two years, and were from 12 to 24 inches in length; the trees were planted in rows at the distance of six feet from each other, and the plants in each row were at the same distance, where rocks would permit. Holes in the ground were made with a hack, and the plants were well trodden down. The plantations are well fenced with stone walls, and the trees are now in a flourishing condition.

ROBERT ATKINSON.

Oct. 13th, 1806.

Certificates were received from JEREMIAH DIXON, Esq. of Fellfoot, and WILLIAM TOWNLEY, Esq. of Townhead, dated Oct. 12th 1807, declaring the above accounts to be true and correctly stated; that they had lately viewed the ground, and found the plants in a very thriving condition.

The GOLD MEDAL *of the Society, being the Premium offered for gaining the greatest Quantity of* LAND *from the Sea, was this Session adjudged to the Right Hon.* LORD BORINGDON, *from whom the following Accounts were received.*

SIR,

OBSERVING in the last Volume of the Transactions for the Encouragement of Arts, Manufactures, and Commerce, that

that amongst the various Premiums offered by the Society, a Premium is proposed to " the person who shall produce to the Society an account, verified by actual experiment, of his having gained the greatest quantity of land from the sea, not less than 50 acres, on the coast of Great Britain and Ireland, and that the work was commenced subsequently to the 1st of January 1800." I have the honour to acquaint you, that by means of an embankment, which was begun in the spring 1806, I have obtained from the sea 175 acres.

The land which has been gained was formerly called Chelson Bay, and was overflowed twice every 24 hours by the tide of the sea. For the construction of the embankment I contracted with Mr. James Green, Engineer, of Birmingham, a gentleman of very distinguished science in the profession to which he belongs, and to whose unceasing zeal and attention I attribute the success of the work. The embankment is about 970 yards, or 2910 feet in length, the average height above the surface of the mud is about 16 feet perpendicular, at which height it is considered to be two feet above the highest tide ever known; the average width of the base is about 91 feet, the width at top three feet, the slope on the outside (next to the sea) is covered with limestone paving, underneath which is a water-tight puddle of about three feet thick, which prevents the water penetrating in any part; the inside slope is soiled and sown with grass seeds. It was originally intended to give the surface of the embankment (next to the sea) a regular slope throughout, of four feet horizontal to one foot perpendicular, and to make the inside slope as one foot six inches horizontal to one foot perpendicular; but, in the progress of the work, it was ascertained that the embankment would require to be

raised two feet higher than had been at first apprehended, and it became necessary to widen the base in order to increase the height; and as the front slope was then in great part paved, this could best be done on the inside.

On adding this additional weight of earth to the embankment, the mud on which it was founded gave way, in such a manner as to render it next to impossible to continue the slopes in the form first intended; in order therefore to rest, as much as possible, the additional weight on the great body of materials, it was determined to give the last three feet in height a slope of two feet horizontal to one foot perpendicular, (in front,) joining it to the flatter part of the slope to avoid a direct angle by giving it a concave appearance; the width of the top of the embankment is continued three feet, and the inside slope is increased to five feet horizontal to three feet perpendicular. This alteration appears to have had the desired effect.

The water coming from the high lands on each side of the land embanked, is collected in a drain cut for that purpose, and carried over the embankment. The rain which may fall on the surface of the mud land, as well as the spring-water rising therein, is carried off by means of a sluice of three feet by two feet area, composed of the best three-inch oak plank, framed together and supported by piles and cross beams; the bottom of this sluice is on a level with the low-water mark of the highest spring tides.

The land gained is, for the most part, rich argillaceous loam, in many places 20 feet deep, and at present greatly impregnated with marine salt. Nearly one-third of the land has already been ploughed. The abundant rains which in the winter season usually fall in this part of England, and the being enabled to float with fresh water a considerable portion of the new land, lead me to think

that

that by next spring the marine salt will, in a great degree, be extracted, and that in June the land will be fit for sowing. The Secretary of the Board of Agriculture has, upon my application to him, been so obliging as to point out to me the only written detailed accounts of similar experiments, and of the subsequent treatment of the lands acquired. Those details to which he referred me are to be found in Vol. IV. p. 49, of the Transactions of the Society of Arts; in his own Annals of Agriculture, Vol. II. p. 82; and his Norfolk Report, p. 438. As all these accounts concur in stating that the respective new lands have been sown with rape, and also that abundant crops had ensued, it is my intention to sow in June next the greatest part (though probably not the whole) of the land in question with that seed, and I entertain but little doubt of having as favourable crops as those which are mentioned in the papers to which I referred. The Plymouth Road Company having recently, by public auction at Plymouth, sold at the rate of 130*l.* per acre 30 other acres of newly-gained land (called Tolhill Bay), which (with exception that no part of them is yet ploughed, and that the soil itself is considered as inferior to mine) is precisely in the same condition as mine, and nearly about the same distance from Plymouth, I consider that the land which I have gained would, if now offered for sale, produce about 25,000*l.* The expenses of the work have amounted to about 9000*l.* I have also within two years gained, by an embankment from the sea, 40 acres of land at Charlton, near Kingsbridge, in this county, making in the whole 215 acres.

I have the honour to be, Sir,

Your obedient humble Servant,

BORINGDON.

Saltram, Nov. 19, 1807.

To C. Taylor, M. D. Sec.

The following Certificates of the truth of the foregoing statement, have been received by the Society, with the respective signatures, as annexed.

Nov. 19, 1807.

We hereby certify, that by a map, which we have every reason to think accurate, Chelson Bay contains about 175 acres; that the said bay was, previous to the new embankment, regularly overflowed by the tide of the sea; that the embankment now excludes it from such overflow; that a considerable part of the new land is already ploughed, and that the embankment was begun subsequently to the 1st of January, 1800.

John Harris, Radford.
John Arscott, Clerk, Plympton.
Rev. William Hayne, Minister of Plympton St. Mary's.
R. Williams, Surgeon, Plympton.
E. Start, Pomplett.
T. Norris, Tozer Wixenford.
Isaac Blackburn, Turnchapel.
Richard Worth, Herdwick.

A Certificate, testifying that the tide of the sea overflowed about forty acres of mud land at Charlton, near Kingsbridge, previous to Lord Boringdon's making the new embankment there, and that such embankment now excludes it from such overflow, and that it was begun subsequently to the 1st of January, 1800.

Richard Chaffon.
John Yolland, Merrifield.
William Pearce, Charlton.

The

The SILVER MEDAL *of the Society was this Session adjudged to* WILLIAM LAWRENCE, *Esq. of Maldon in Essex, for gaining* LAND *from the Sea. The following Communications were received from him, and a Map of the Land is preserved for Inspection in the Society's House.*

SIR,

THE Certificate which accompanies this letter will I believe give you all the particulars necessary for a claim I now presume to make, for gaining land from the sea.

In the summer of 1806, I applied to the Dean and Chapter of St. Paul's, for a lease of the saltings now inclosed, which were part of the demesne lands of their manor of Heybridge Hall, near this town, and which (after they had given their tenant the offer, and he had refused to have them, alledging they were not worth the expense of inclosing) they consented to grant, and have now demised to me, for twenty-one years from Michaelmas last, at the rent of five pounds, renewable every seven years, on payment of a fine, and in the usual form of church leases; and notwithstanding the land is only leasehold, I trust the inclosure will well answer my expectation, although the greatest advantage will be derived by the Dean and Chapter of St. Paul's, for I have not only added near one hundred acres of land to their estate, but by the erection of a new bank or sea wall, they get a foreland to their former estate secured by it, instead of an old rotten bank, which in my opinion was insecure; and the land now leased to me was of little or no value to their tenant.

My

My first application to them was not for the land now inclosed, but for other saltings very near the town of Maldon, but as they were already promised to another person, with other lands to which they had always been annexed, my wish could not be complied with. It is the prevailing opinion of this neighbourhood, and generally supposed correct, that the stagnated water in the *pans*, as they are called, or holes in the saltings, along with the exhalations from the uninclosed lands, and oose or mud near the river, occasion the agues to which this neighbourhood is subject, and my motive for applying for the saltings near the town, was as much for the benefit of the health of my neighbours as for my own emolument.

It really would be very beneficial if the Dean and Chapter would make some allowance to their tenant, to enable him to embank this piece, for it would greatly improve their property, and benefit the town, to which at present it is a great nuisance; and as the work would be expensive, the tenant cannot be expected to do it without some compensation. I shall in some degree contribute to the health of the neighbourhood by my embankment; but not to the extent I should have done, had a lease of the other part been granted to me.

A plan of the new wall and a map of the land accompany the certificate: you will observe by the latter, that if I could have run the wall across the creek, or the north-east of the land, near Burrow Hills Mill, it would have saved forty rods of walling; but that was not practicable on account of the water which supplies the mill, ebbing and flowing through this creek or channel, at the end of which is a salt office, to which barges laden with rock salt pass and repass, and therefore the navigation could not be stopped.

On

On the land inclosed are several hills, which are supposed to be Tumuli, thrown up by the Danes after the desperate battle fought here when they invaded this kingdom. These are now intended to be mixed with chalk, and spread on the land as manure.

This land will have an advantage which very few salt marshes possess, as I have now the liberty of diverting a water-course, which will not only supply every part of it, at all times, with good spring-water from Tiptree Heath, but will also fill the ditches of the adjoining lands, which were generally dry in summer.

The whole wall and sluices were completed in ten weeks, although the work was delayed by a very high tide on Christmas-day last, which run over a part of the wall before it was completed, and gullied it in several places; but no material damage was done, although the wall was not so high as at present, by nearly two feet.

The late high tide, on the 30th September last, did not rise to the height of the wall in any part, not even where the rills had been stopped, and where it had sunk considerably, but since raised, although it run over several old embankments in the neighbourhood, inundated the lands, and did much damage in Essex.

I am, Sir, with great respect,

Your obedient Servant,

WILLIAM LAWRENCE.

Maldon, Nov, 2, 1807.

To C. Taylor, M.D. Sec.

We,

CERTIFICATES.

We, whose names are hereunder written, the Vicar, Churchwarden, and Overseer of the parish of Heybridge, in the county of Essex, hereby certify, that a piece of land, in the parish aforesaid, called the Saltings, containing ninety-nine acres, two roods, and twenty-three poles, has, within the last twelve months, been inclosed by Mr. Wm. Lawrence, of Maldon, from the Black Water river or bay, which is an arm of the sea; and that the land so inclosed is greatly improved thereby, and will shortly become valuable, being well secured from inundation of the sea, by which it has heretofore been overflowed at spring tides.

We further certify, that the embankment is in length two hundred and ninety rods, the base whereof is twenty feet; its height five feet; and the width at the top four feet; the slope on the side next the sea is ten feet, and on the land side six feet; and there is also a good foreland towards the sea. The said embankment is made of soil only, and there are two sluices or gutters under it, which drain the land inclosed. We believe the whole expense of inclosing the said saltings (exclusive of marsh ditches, gates, &c.) to be as follows, viz.

	£.	s.	d.
To 290 rods of walling or embanking, at 1*l.* 6*s.* per rod . . .	370	0	0
To planks, barrows, and tools .	50	0	0
To a sluice or gutter, 46 feet long, and 2 feet clear run . . .	51	3	7½
To one do. repaired, 46 feet long, and 18 inches run . . .	28	8	6
To cartage and extra charges . .	7	18	10
£.	507	10	11½

In

In addition to the above expenses, a considerable sum has been paid for levelling the rills and holes, and in making marsh ditches, gates, &c.

Signed by

Fr. J. Waring, A. M. Vicar.
R. Francis, Churchwarden.
Rt. Clark, Overseer.
James Shynm.
D. P. Francis.

Maldon, Oct. 28, 1807.

SIR,

In answer to your letter of the 1st instant, I have to inform you, that the embankment is made of soil only, but it is not thrown loosely together, it is composed of the earth which was taken and produced by making a ditch on the land side of the embankment, and from the green sward and soil taken from off the foreland on the sea-side. This earth was thrown together to form the wall or embankment, and after every layer, well rammed or pounded together by the workmen. It was made so firm and consistent as not to have sunk perceptibly, except where some deep creeks and rills were filled up, which are now made good. Since finished, there have been some very high tides, and sometimes a strong surge beating against the embankment, but without doing it the least injury.

I did not sow any grass seeds on the bank when it was finished, because, as it was much impregnated with salt, I considered that it would be scorched up by the summer heat, even if it should begin to vegetate; but as it has now been exposed to the sun and air for a whole summer and winter.

winter, I intend sowing grass seeds thereon, where there is no herbage already. This is not customary here, for the land is generally left to nature, and frequently many years elapse before a natural green sod is formed, and that is commonly a species of twitch grass. By sowing it with grass seeds, I expect in a year or two to have some good sheep-food upon it. Mr. Waltham, and several gentlemen experienced in works of this kind, have inspected this embankment, and think it exceedingly well done. Six or seven acres of the land thus inclosed were ploughed up early in the last winter, and the quality of the soil appears to be excellent; this part is now sown with black oats, and if the experiment answers, more of the land will be broken up next winter.

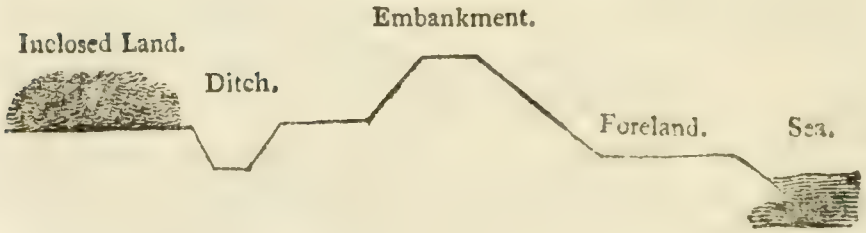
I remain, Sir,

Your obedient Servant,

WM. LAWRENCE.

Maldon, April 4th, 1808.

To CHARLES TAYLOR, M. D. SEC.



The

The GOLD MEDAL *of the Society was this Session adjudged to* A. BAIN, *M. D. of Curzon Street, for planting* 338,199 *Forest Trees, at Heffleton, in Dorsetshire. The following Communications were received from him.*

SIR,

I BEG leave to inform you, that in the year 1798, I began to make plantations of forest trees on a small scale at Heffleton, in the county of Dorset, on ground which was, in general, valued at 5s. an acre; and previously to the year 1804, I had covered about 50 acres of such land with trees which are considered to thrive as well as any in that neighbourhood. No accurate account has been kept of the number and sorts, but making allowance for the difference of ground, they were planted much upon the same plan as those which I shall proceed to detail, except that they were thicker together, and were probably 3000 to an acre, making in the whole 150,000 trees.

Encouraged by my success, I inclosed 250 acres of heath ground, with a bank and ditch, for the purpose of planting it chiefly with firs. The soil is very thin, for the most part not more than two inches, though in some places deeper, but of a poor hungry nature, producing only stunted heath, or white grass of a bad quality; the subsoil is gravel or sand. The land had never been valued to the tenant at more than a shilling an acre, and was certainly not worth more. The bank and ditch were made by the perch, at the expense of 1s. 6d.; small furze plants were put in the face of the bank at 1s. 8d. per thousand; and furze seed after-

wards sown to fill up the drills where the plants had failed, or in some places to form a future fence. When the planting was begun, a dead hedge was made on the top of the bank; or fence hurdles, six feet long, and two feet high, were placed on its summit, to prevent the heath sheep, which are active and enterprising, from getting into the plantations before the furze, by its growth, should have completed the security of the fence. Two thousand trees and upwards were allotted to each acre, and the ground was prepared for receiving them in the following manner: A round thin piece of turf, from one and a half to two feet in diameter, was pared off with a sharp spade or an axe-hoe, and thrown away. This small spot of ground, divested of its heath, was then dug and chopped one foot deep with a spade, or if hard and stony, with an axe-hoe, by which the roots of the heath were completely divided; and these little spaces of ground, without taking out any of the earth, were allowed to rot and mellow one or two years before they were filled with plants. This preparation cost little more than a guinea an acre; and, in similar soils, I can recommend it with much confidence. As most of the ground was elevated, and exposed to the strong sea winds of the south coast, which is only four or five miles distant, the planting was begun to the south-west of the whole with Scotch firs, intermixed with some spruce and pinaster, having convinced myself, by repeated trials, that no other trees would succeed so well in that soil and exposure. The firs were raised in my own nursery, or in the immediate neighbourhood, or were procured from Mr. Whitley of Brompton; and in either case, having been transplanted, and allowed to remain at least one season in my own nursery, they and the others were planted out in general at three

three years old. The deciduous trees were mostly raised by my gardener, and were excellent of their kinds. About 160 acres were planted between the first of October 1804, and the first week in December 1805; and the number of trees planted in that time was 338,199, as the annexed list will show:

Scotch fir, 289,555; oak, 4,362; larch, 12,290; Sp. chesnut, 5,647; spruce, 3,450; ash, 11,050; pinaster, 1,900; sycamore, 4,050; birch, 1,700; hazel, 4,195.

It should be observed that the roads, some of which are thirteen yards wide, are included in the portion of heath above stated. The plantation, for so poor a soil, has succeeded remarkably well. The firs, except the larch, are in a healthy thriving state, and the pinasters grow nearly as fast again as the others. It will be seen by the above account, that the oak, chesnut, and larch bear a small proportion to the Scotch firs, and I have only reason to regret that their proportion was not still smaller; for although they were planted in the best soil and most sheltered places, they have a very unpromising appearance. The larch, with some exceptions, were planted in declivities and gravelly vallies, screened by hills to the south-west from the influence of sea air and blowing winds. They seemed to thrive the first season after planting, yet most of them sickened the second, and died the third; but in lands of a better quality than the inclosure I have described, no tree succeeds with me better than the larch, whatever the exposure may be. The ash and sycamore grow slowly, but I flatter myself that when the firs are sufficiently advanced to shelter them, I shall not have planted them in vain. Next to the Scotch firs and pinasters, the birch thrives best in

every part of my heath, and seems equally regardless of the poverty of the soil, and of the influence of sea winds.

Should the efforts I have made to cover a barren part of the country with trees, entitle me to the honorary premium of the Society, or be deemed worthy of notice in their Transactions, I would take the liberty, through so excellent a medium, to advise the inexperienced planter to receive with caution any recommendation to form plantations of larch on the barren heathy surfaces in the southern counties of England.

I have the honor to be, Sir,

Your obedient humble servant,

A. BAIN.

Curzon Street, Nov. 27, 1807.

P. S. The certificates I have obtained of the present state of the plantation, refer solely to those trees which were planted between the first of October 1804, and the first of April 1805, agreeably to the rules of the Society. But, had it been permitted, I could have brought similar testimony to the state of the trees which were planted later in the year 1805, since which period I have been engaged in planting land of the same description; so that from the year 1798 to the present time, I have planted upwards of 800,000 trees in 400 acres of ground.

Certificates of the truth of the foregoing statement have been received by the Society, signed by

NATHANIEL W. PEACH, Esq. of Dudbridge.
THOMAS BARTLETT, Esq. of Wareham.
RICHARD VINCENT, Gardener to Dr. BAIN, at Heffleton.

The

The GOLD MEDAL *of the Society was this Session voted to Mr.* CHARLES WAISTELL, *of High Holborn, for his Method of ascertaining the Value of growing Timber Trees, at different and distant Periods of Time. The following Communications were received from him.*

SIR,

CONCEIVING that the Tables contained in the annexed papers will afford useful information to growers of timber, and tend to encourage the growth of it in these kingdoms, and thereby promote the views of the Society of Arts, &c. I trust you will have the goodness to lay them before the Society, as I have formed them with great attention.

Having last autumn viewed some plantations made under my direction about thirty years ago, I found the value of one of them much to exceed my expectation. I became therefore desirous to devise some means of estimating what its value might probably be at different future periods. I was thus led to construct the first of these tables, and on the completion of this, other tables seemed necessary, and I was thus progressively led on to the construction of the whole. For this purpose I searched in various authors for the measure of trees, in girt and height, at different ages, and obtained similar information among my acquaintance. Hence I collected, that the increase in the circumference of trees is generally from about one to two inches annually, and from twelve to eighteen inches the annual increase in height. Some fall a little short, and some exceed those measures.

I shall now briefly notice a few of the advantages to be derived from the first Table.

1st. The first Table shows every fourth year, from twelve years old to an hundred, the rates per cent. per annum at which all trees increase, whether they grow fast or slow, provided their rate of growth does not vary. This table may be the means of saving young thriving woods from being cut down, by showing how great a loss is sustained by felling timber prematurely *.

2d. And it may be the means of bringing old trees to market, by showing the smallness of the interest they pay for the money they are worth, after they are 80 or 100 years old.

But this table shows the interest which they pay, only, whilst the trees continue growing at their usual rate. In case they fall short only a little of their usual increase in girt, this considerably diminishes the rate per cent. per annum of their increase. And trees do decrease in their rate of growth before they appear to do so †. A pale and mossy bark are certain indications of it.

3d.

* "A wood, near West Ward, in Cumberland, of more than 200 acres, was felling in 1794, it was little more than 30 years old. The whole was cut away without leaving any to stand." *See Miller's Gardener's Dictionary, last edition, under the Head of Woods.*

At 30 years old timber pays 10 per cent. for standing, and probably this wood might have paid 7 per cent. per annum on an average for the next 30 years.

† In Mr. Pringle's Agricultural Report for Westmoreland is a paper of the Bishop of Llandaff's, stating, "That a very fine oak, of 82 years growth, measured in circumference at 6 feet from the ground, on the 27th of October 1792, 107 inches, and on the same day of the same month in 1793 it measured 108 inches." He then states the interest it paid to be only about 2 per cent. and says this

tree

3d. The 1st Table may also assist the valuer of such timber as is not to be cut down, but to continue growing, by enabling him to estimate its present value more accurately than is usually done, especially when it is increasing after a high rate per cent. per annum*.

The 2d Table shows the rate per cent. to be the same as in the first Table, though the annual increase is more both in height and circumference.

The 3d Table is calculated to show the number of trees that will stand on an acre of ground, at the distance of one fifth of their height, (which distance is recommended by Mr. Salmon, in a paper in the Society's 24th volume,) and the number of feet the trees will contain, both those to be cut out, and those to be left standing, at the end of every four years, from 16 to 64 years old, supposing they increase 12 inches in height and 1 in circumference annually. This distance may suit fir trees, but will be too near for oaks.

The 4th and 5th Tables show the same particulars when the trees grow at greater rates.

The 6th Table is calculated to show the same particulars when the trees are constantly thinned out every four years, so as to leave them at the distance of one-fourth of their

tree was a singularly thriving one. It is evident that, with all this appearance of thriving, it was on the decline. For if we divide 108, its inches in circumference, by 82, its age, we find its average annual increase had been 1 inch and a third. Its falling off to 1 inch reduced the rate per cent. of increase one-fourth.

* A fir wood of more than 30 acres, and about 80 years old, was lately valued to be sold with an estate, by several eminent wood valuers, without taking into consideration its rate of increase. It was then increasing after the rate of 10 per cent. per annum, and probably would increase after the rate of 8 per cent. on an average for the next 20 years.

height. According to this table there will be 48 trees left on an acre when they are 120 years old; and it seems generally agreed, that from 40 to 50 full grown oak trees, are as many as have sufficient room to stand on an acre.

The 7th Table shows the same particulars respecting trees which increase 15 inches in height and 1½ inch in circumference annually.

The 8th Table shows the same particulars respecting trees which increase 18 inches in height, and 2 inches in circumference annually.

The 9th Table shows the same particulars as Table 6, till the trees are 28 feet high, after which the distance is increased from one-fourth to one-third of their height.

The 10th, 11th, and 12th Tables show the annual increase in boles of 24, 32, and 40 feet long, and the difference of their increase at the same ages.

To these Tables succeed comparative statements, showing the number of feet contained in boles of different lengths, when the trees are 60 years old; by which it appears, that, if cut down at that age, the longest boles are not the most profitable to the growers of timber.

And I have added the valuation of the plantations before alluded to, with remarks on them.

Having finished my introductory remarks, I conclude, and am, Sir,

Your very humble Servant,

CHARLES WAISTELL.

TABLES

TABLES RESPECTING THE GROWTH OF TIMBER.

CALCULATIONS, showing every fourth year, from 12 to 100, the progressive annual increase in the growth of trees, and gradual decrease in the rate per cent. per annum, that the annual increase bears to the whole tree.

The whole height of the trees is taken to the top of the leading shoot, and the girt in the middle; but no account is taken of the lateral branches.

If trees increase 12 inches in height and 1 in circumference annually, their increase will be as undermentioned, viz.

TABLE I.

Years old & ft. high	Girt.	Contents.			Years old & ft. high	Girt.	Contents.				One year's increase.				Rate per cent. of increase.
	inch.	ft.	in.	pts		inch.	ft.	in.	pt.	sds.	ft.	in.	pt.	sds.	
12	1½	0	2	3	13	1[illegible]	0	2	10	3	0	0	7	3	26·8
16	2	0	5	4	17	2[illegible]	0	6	4	9	0	1	0	9	19·9
20	2½	0	10	5	21	2[illegible]	1	0	0	8	0	1	7	8	15·7
24	3	1	6	0	25	3[illegible]	1	8	4	1	0	2	4	1	13·
28	3½	2	4	7	29	3[illegible]	2	7	9	1	0	3	2	0	11·
32	4	3	6	8	33	4[illegible]	3	10	9	6	0	4	1	6	9·67
36	4½	5	0	9	37	4[illegible]	5	5	11	5	0	5	2	5	8·5
40	5	6	11	4	41	5[illegible]	7	5	8	10	0	6	4	10	7·6
44	5½	9	2	11	45	5[illegible]	9	10	7	9	0	7	8	9	6·95
48	6	12	0	0	49	6[illegible]	12	9	2	3	0	9	2	3	6·35
52	6½	15	3	0	53	6[illegible]	16	1	10	2	0	10	10	2	5·9
56	7	19	0	8	57	7[illegible]	20	1	1	7	1	0	5	7	5·4
60	7½	23	5	2	61	7[illegible]	24	7	6	6	1	2	4	6	5·1
64	8	28	5	4	65	8[illegible]	29	9	7	0	1	4	3	0	4·76
68	8½	34	1	4	69	8[illegible]	35	7	8	11	1	6	4	11	4·49
72	9	40	6	0	73	9[illegible]	42	2	6	4	1	8	6	4	4·2
76	9½	47	7	6	77	9[illegible]	49	6	5	2	1	10	11	2	3·93
80	10	55	6	8	81	10[illegible]	57	7	11	9	2	1	3	9	3·79
84	10½	64	3	8	85	10[illegible]	66	7	7	8	2	3	11	8	3·6
88	11	73	10	4	89	11[illegible]	76	5	11	1	2	7	7	1	3·5
92	11½	84	5	9	93	11[illegible]	87	3	4	0	2	9	7	0	3·3
96	12	96	0	0	97	12[illegible]	99	0	4	6	3	0	4	6	3·15
100	12½	108	6	0	101	12[illegible]	111	9	6	8	3	3	6	8	3·

In Table X. of the increase of a bole of 24 feet in height, of a tree growing at the above-mentioned rate, it will be observed, that the contents at 24 years of age are the same, and at 64 years nearly the same as in the above Table, but the contents of the bole at all the intermediate periods exceed the above. And a 40 feet bole exceeds the above contents from 44 years to 100, as may be seen in Table 12.

For

For these reasons chiefly I did not think it necessary to take into consideration the decrease in height that takes place in trees at different ages, according to the kind of tree and quality of the soil.

The increase per cent. per annum is the same as the above in all trees at the same age, whether they have grown faster or slower, provided their increase in height and thickness annually has not varied on an average. The progress of trees is sometimes greatly retarded by insects destroying their leaves, by unfavourable seasons, and by their roots penetrating into noxious strata. But these accidents cannot enter into calculations.

CALCULATIONS, showing every fourth year from 12 to 64, the progressive annual increase in the growth of trees, and the gradual decrease in the rate per cent. per annum that the annual increase bears to the whole tree.

The whole height of the trees is taken to the top of the leading shoot, and the girt in the middle; but no account is taken of the lateral branches.

If trees increase eighteen inches in height, and two inches in circumference, annually, their increase will be as undermentioned, viz.

TABLE II.

Age of Trees.	Height	Girt.	Contents.			Age of Trees.	Height	Girt.	Contents.				One year's increase.			Rate per cent. of increase.
	feet.	in.	ft.	in.	pt.		feet.	inch	ft.	in.	pt.	sd.	ft.	in.	pt. sd	
12	18	3	1	1	6	13	19½	3¾	1	5	1	0	0	3	7 0	26·5
16	24	4	2	8	0	17	25½	4¼	3	2	4	0	0	6	4 0	19·8
20	30	5	5	2	6	21	31½	5¼	6	0	3	6	0	9	9 6	15·6
24	36	6	9	0	0	25	37½	6¼	10	2	0	6	1	2	0 6	13·
28	42	7	14	3	6	29	43½	7¼	15	10	6	0	1	7	0 0	11·
32	48	8	21	4	0	33	49½	8¼	23	4	8	0	2	0	8 0	9·6
36	54	9	30	4	6	37	55½	9¼	32	11	7	6	2	7	1 6	8·5
40	60	10	41	8	0	41	61½	10¼	44	10	5	6	3	2	3 6	7·6
44	66	11	55	5	6	45	67½	11¼	59	3	10	0	3	10	4 0	6·9
48	72	12	72	0	0	49	73½	12¼	76	7	1	0	4	7	1 0	6·3
52	78	13	91	6	6	53	79½	13¼	96	10	11	6	5	4	5 6	5·8
56	84	14	114	4	0	57	85½	14¼	120	6	8	6	6	9	8 6	5·4
60	90	15	140	7	6	61	91½	15¼	147	9	2	0	7	1	8 0	5·
64	96	16	170	8	0	65	97½	16¼	178	9	4	0	8	1	4 0	4·7

Explanation

Explanation of the Construction of Tables I. and II.

To render the preceding tables easy to be understood by persons not accustomed to calculations, I will state the process of the operations in the first line of Table II.

The height of the tree at 12 years of age is supposed to be 18 feet to the top of its leading shoot, and 24 inches in circumference at the ground, consequently, at half the height, the circumference is 12 inches,—one-fourth of this, being three inches, is called the girt. The girt being squared and multiplied into the height, gives one foot one inch and six parts for its contents. At 13 years old the tree will be 19½ feet high, 26 inches in circumference at the ground, and 13 inches at half the height; one-fourth of 13 gives 3¼ inch for the girt. This squared and multiplied into the height, gives one foot five inches and one part for the contents. Deduct from this the contents of the tree at 12 years of age, and there remains three inches and seven parts, which is the increase in the 13th year. Then reduce the contents of the tree when 12 years old, and the increase in the 13th year, each into parts, dividing the former by the latter, and the quotient will be 3·76; by this number divide 100, and the quotient is 26·5, which is the rate per cent. of increase made in the thirteenth year; consequently whatever the tree might be worth when 12 years old, it will, at the end of the 13th year, be improved in value after the rate of 26*l.* 10*s.* per cent. or in other words, that will be the interest it will have paid that year for the money the tree was worth the preceding year.

At every succeeding period, both in this Table and Table I. the like process is gone through.

Observations

Observations on Tables I. and II.

The preceding tables furnish us with the following useful information, viz.

1st. That all regular growing trees, measured as above, as often as their age is increased one-fourth, contain very nearly double their quantity of timber.

2nd. That when a tree has doubled its age, its contents will be eight-fold.

3d. That when a tree has doubled its age, the annual growth will be increased four-fold.

4th. Consequently that when a tree has doubled its age, the proportion that its annual increase bears to the contents of the whole tree, is then diminished one-half.

This last observation explains how it comes to pass that a tree, when its age is doubled, the rate per cent. per annum that its increase then bears to the content of the whole tree, is diminished one-half.

It may not be unuseful to observe, that the rate per cent. of increase in the last columns, is the same as the rate per cent. that the increase of the tree that year will pay for the money it was worth the preceding year.

In the two preceding tables, we find that the rate of increase per cent. per annum is the same in both at the same ages, although the quantity of timber in the second table is six times as much as in the first table in trees of all ages; therefore, when the age of a tree is known, the rate per cent. per annum of its increase is known on inspecting these tables, whether the tree has grown fast or slow; provided the growth of the tree has been regular, and that it has continued its usual growth.

And having the age, girt, and height of any tree given, we can readily calculate what quantity of timber it will contain at any future period whilst it continues its usual rate of growth.

A TABLE

A TABLE *showing the Number of Trees to be cut out in thinning of Woods, and the Number left standing at every Period of* 4 *Years from* 20 *up to* 64 *Years.*

In the 24th Volume of the Transactions of the Society of Arts, &c page 75, Mr. Salmon, in a paper on the Management of Fir Woods, says, " the distance of trees from each other should be one-fifth of their height." At that distance, which is probably sufficient for fir trees, the following will be the number on an acre, and the number to be cut out at the ages and heights under-mentioned, and the number of feet they will then contain in the bole, when measured to the top of the leading shoot. These trees are supposed to increase twelve inches in height, and one in circumference annually, and to have been at first planted four feet apart.

TABLE III.

Years old and feet high.	Girt.	Contents.			Distance.	Number of Trees on an Acre.	Contents of the whole.	Number to be cut out.	Contents
	inch.	ft.	in	pts.	feet		feet.		feet.
20	$2\frac{1}{2}$	0	10	5	4·	2722	2362	839	727
24	3	1	6	0	4·8	1883	2824	494	741
28	$3\frac{1}{2}$	2	4	7	5·6	1389	3308	326	776
32	4	3	6	8	6·4	1063	3779	223	792
36	$4\frac{1}{2}$	5	0	9	7·2	840	4252	160	810
40	5	6	11	4	8	680	4722	118	819
44	$5\frac{1}{2}$	9	2	11	8·8	562	5194	90	831
48	6	12	0	0	9·6	472	5664	70	840
52	$6\frac{1}{2}$	15	3	0	10·4	402	6130	55	838
56	7	19	0	8	11·2	347	6611	45	857
60	$7\frac{1}{2}$	23	5	2	12·	302	7076	37	866
64	8	28	5	4	12·8	265	7537		

And

And if trees be periodically thinned out to the distance of one-fifth of their height, and that they increase fifteen inches in height, and one inch and a half in circumference annually, the number of trees on an acre, and the number to be cut out at different periods, and the number of feet they will respectively contain at those periods, will be as under, viz.

TABLE IV.

Age.	Hght.	Girt.	Contents.			Distance.	Number of trees on an acre.	Contents of the whole.	Number to be cut out	Contents
years.	feet.	inch.	ft.	in.	pts.	feet.		feet.		feet.
16	20	3	1	3	0	4	2722	3402	980	1225
20	25	$3\frac{3}{4}$	2	5	3	5	1742	4246	532	1296
24	30	$4\frac{1}{2}$	4	2	7	6	1210	5100	322	1357
28	35	$5\frac{1}{4}$	6	8	4	7	888	5944	208	1392
32	40	6	10	0	0	8	680	6800	143	1430
36	45	$6\frac{3}{4}$	14	2	10	9	537	7644	102	1452
40	50	$7\frac{1}{2}$	19	6	4	10	435	8494	75	1464
44	55	$8\frac{1}{4}$	25	11	10	11	360	9355	58	1507
48	60	9	33	9	0	12	302	10192	45	1518
52	65	$9\frac{3}{4}$	42	10	10	13	257	11026	35	1501
56	70	$10\frac{1}{2}$	53	7	0	14	222	11895	29	1553
60	75	$11\frac{1}{4}$	65	10	11	15	193	12720	23	1515
64	80	12	80	0	0	16	170	13600		

It will be observed in all these tables, that when trees have doubled their age, there are only one-fourth of the number remaining on an acre, in consequence of their distance being doubled; but as each tree will then have increased its contents eight-fold, therefore the number of feet on an acre must be then doubled. Above, at 64 years of age, there is exactly double the number of feet that there is at 32 years of age.

And

And if trees be periodically thinned out to the distance of one-fifth of their height, and that they increase eighteen inches in height, and two inches in circumference, annually, the number of trees on an acre, and the number to be cut out at different periods, and the number of feet they will then respectively contain, will be as under, viz.

TABLE V.

Age	Hght.	Girt.	Contents.			Distance.	Number of trees on an acre.	Contents of the whole.	Number to be cut out.	Contents
year.	feet.	inch.	ft.	in.	pt.	feet.		feet.		feet.
12	18	3	1	1	6	4	2722	3062	839	943
16	24	4	2	8	0	4·8	1883	5021	673	1794
20	30	5	5	2	6	6·	1210	6302	370	1927
24	36	6	9	0	0	7·2	840	7560	223	2007
28	42	7	14	3	6	8·4	617	8817	145	2072
32	48	8	21	4	0	9·6	472	10069	99	2112
36	54	9	30	4	6	10·8	373	11314	71	2153
40	60	10	41	8	0	12·	302	12583	52	2166
44	66	11	55	5	6	13·2	250	13864	40	2218
48	72	12	72	0	0	14·4	210	15120	32	2304
52	78	13	91	6	6	15·6	178	16294	24	2197
56	84	14	114	4	0	16·8	154	17607	20	2286
60	90	15	140	7	6	18·	134	18843	16	2250
64	96	16	170	8	0	19·2	118	20138		

But if the trees be first planted four feet apart, and be periodically thinned out to the distance of one-fourth of their height, and that they increase twelve inches in height, and one in circumference, annually, the number of trees on an acre, and the number to be cut out at the ages and

and heights under-mentioned, and the number of feet they will respectively contain in the bole, when measured to the top of the leading shoot, will be as under, viz.

TABLE VI.

Years old & feet high.	Girt.	Contents.			Distance	Number of trees on an acre.	Contents of the whole.	Number to be cut out.	Contents.
	inch.	ft.	in.	pt.	feet.		feet.		feet.
16	2	0	5	4	4	2722	1209	980	435
20	2½	0	10	5	5	1742	1512	532	461
24	3	1	6	0	6	1210	1815	322	483
28	3½	2	4	7	7	888	2115	208	495
32	4	3	6	8	8	680	2417	143	508
36	4½	5	0	9	9	537	2718	102	516
40	5	6	11	4	10	435	3020	75	520
44	5½	9	2	11	11	360	3327	58	536
48	6	12	0	0	12	302	3624	45	540
52	6½	15	3	0	13	257	3919	35	533
56	7	19	0	8	14	222	4230	29	551
60	7½	23	5	2	15	193	4522	23	538
64	8	28	5	4	16	170	4835	20	568
68	8½	34	1	4	17	150	5116	16	545
72	9	40	6	0	18	134	5427	14	567
76	9½	47	7	6	19	120	5715	12	571
80	10	55	6	8	20	108	6000	10	555
84	10½	64	3	8	21	98	6301	8	554
88	11	73	11	4	22	90	6655	8	591
92	11½	84	5	11	23	82	6928	7	591
96	12	96	0	0	24	75	7200	6	576
100	12½	108	6	0	25	69	7486	5	542
104	13	122	0	8	26	64	7811	5	610
108	13½	136	8	3	27	59	8037	4	546
112	14	152	5	4	28	55	8384	4	609
116	14½	169	4	5	29	51	8659	3	508
120	15	187	6	0	30	48	9000	3	562
124	15½	206	10	7	31	45	9309	3	620
128	16	227	6	8	32	42	9557	2	455
132	16½	249	6	8	33	40	9982		

And

And if the trees be periodically thinned out to the distance of one-fourth of their height, and that they increase 15 inches in height, and one inch and a half in circumference annually, the number of trees on an acre, and the number to be cut out at the different periods under-mentioned, and the number of feet they will respectively contain at those periods, will be as under, viz.

TABLE VII.

Age.	Height.	Girt.	Contents.			Distance	Number of trees on an acre.	Contents of the whole.	Number to be cut out.	Contents.
Years.	feet.	inch.	feet.	in.	pts.	feet.		feet.		feet.
12	15	$2\frac{1}{4}$	0	6	3	4·	2722	1417	980	510
16	20	3	1	3	0	5·	1742	2177	627	783
20	25	$3\frac{3}{4}$	2	5	3	6·25	1115	2717	341	831
24	30	$4\frac{1}{2}$	4	2	7	7·5	774	3262	206	868
28	35	$5\frac{1}{4}$	6	8	4	8·75	568	3802	133	890
32	40	6	10	0	0	10·	435	4350	91	910
36	45	$6\frac{3}{4}$	14	2	10	11·25	344	4897	66	938
40	50	$7\frac{1}{2}$	19	6	4	12·5	278	5428	48	937
44	55	$8\frac{1}{4}$	25	11	10	13·75	230	5976	37	962
48	60	9	33	9	0	15·	193	6513	29	978
52	65	$9\frac{3}{4}$	42	10	10	16·25	164	7036	22	943
56	70	$10\frac{1}{2}$	53	7	0	17·5	142	7608	19	1018
60	75	$11\frac{1}{4}$	65	10	11	18·75	123	8106	15	988
64	80	12	80	0	0	20·	108	8640		

And if the trees be planted at $4\frac{1}{2}$ feet apart, and be periodically thinned out to the distance of one-fourth of their height; and that they increase 18 inches in height and 2 inches in circumference annually, the number of trees on an acre, and the number to be cut out at the different periods under-mentioned, and the number of feet they will then respectively contain, will be as under, viz.

TABLE VIII.

Age.	Height.	Girt.	Contents.			Distance	Number of trees on an acre.	Contents of the whole.	Number to be cut out.	Contents.
Years.	feet.	inch.	feet.	in.	pts.	feet.		feet.		feet.
12	18	3	1	1	6	4·5	2151	2419	941	1058
16	24	4	2	8	0	6·	1210	3226	436	1162
20	30	5	5	2	6	7·5	774	4031	237	1234
24	36	6	9	0	0	9·	537	4833	142	1278
28	42	7	14	3	6	10·5	395	5645	93	1329
32	48	8	21	4	0	12·	302	6442	63	1344
36	54	9	30	4	0	13·5	239	7249	46	1395
40	60	10	41	8	0	15·	193	8041	33	1375
44	66	11	55	5	6	16·5	160	8873	26	1441
48	72	12	72	0	0	18·	134	9648	20	1441
52	78	13	91	6	6	19·5	114	10435	16	1464
56	84	14	114	4	0	21·	98	11201	12	1372
60	90	15	140	7	6	22·5	86	12093	11	1546
64	96	16	170	8	0	24·	75	12800		

It is difficult in thinning plantations to leave the trees at nearly equal distances. The distances stated in all these tables must be considered the average distances. If, for instance, there be 302 trees on an acre, their average distance will be 12 feet, although few of them may stand at exactly that distance.

If

If the trees be first planted 4 feet apart, and be periodically thinned out to the distance of one-fourth of their height until they are 28 feet high, and to one-third of their height afterwards, and that they increase 12 inches in height and one in circumference annually, the number of trees on an acre, and the number to be cut out at the ages and heights under-mentioned, and the number of feet they will then respectively contain in the bole, when measured to the top of the leading shoot, will be as under, viz.

TABLE IX.

Years old and feet high.	Girt.	Contents.			Distance	Number of trees on an acre.	Contents of the whole.	Number to be cut out.	Contents.
	inches.	feet.	in.	pts.	feet.		feet.		feet.
16	2	0	5	4	4	2722	1209	980	435
20	$2\frac{1}{2}$	0	10	5	5	1742	1512	532	461
24	3	1	6	0	6	1210	1815	322	483
28	$3\frac{1}{2}$	2	4	7	7	888	2115	453	1078
30	$3\frac{3}{4}$	2	11	1	10	435	1271	133	388
36	$4\frac{1}{2}$	5	0	9	12	302	1528	80	404
42	$5\frac{1}{4}$	8	0	5	14	222	1783	52	417
48	6	12	0	0	16	170	2040	36	432
54	$6\frac{3}{4}$	17	1	0	18	134	2289	26	444
60	$7\frac{1}{2}$	23	5	2	20	108	2530	18	421
66	$8\frac{1}{4}$	31	2	4	22	90	2807		

Observations on Table IX.

On examining several oak woods, it appeared to me, that the distance of one-third of their height was not too much where the trees were from 30 to 40 feet high and upwards.

I have therefore calculated a table according to the distance of one-fourth of their height, till they are 28 feet high, and according to the distance of one-third of their height afterwards.

The timber to be thinned out before the age of 28 years, will be the same as in Table VI. but at 28 years of age there are 583 feet more to be cut out according to this Table than at the same age in Table VI.; there will however be less to be cut out between the ages of 28 and 60 years of age. But if the trees in this Table, in consequence of having more room, were to increase $1\frac{1}{4}$ inch in circumference annually, instead of 1 inch after they are 28 years of age, the produce of an acre at 60 years of age would equal the produce stated in Table VI. at the same age; taking into consideration that the value of the 583 feet excess cut out at 28 years of age would then be more than quadrupled, if the money were placed out at 5 per cent. compound interest. A considerable additional increase in circumference may certainly be expected, in consequence of the trees having almost double the room in which to extend their branches, and for the admission of those powerful agents, sunshine and air.

Observations on the Tables respecting the Thinning of Woods, and their Produce.

Mr. Salmon is the only person I know of, who has given a general rule for thinning plantations. But as I conceive his distance of one-fifth of their height would leave oaks too close, especially after they had acquired a sufficient length of stem, I have calculated both on his plan, which is proper for fir trees, and also at greater distances.

The

The preceding Tables VI. VII. and VIII. are calculated on a supposition that the trees are never suffered to stand nearer, on an average, than one-fourth of their height; and although the quantities of timber thinned out and left standing on the ground at that distance, at the end of 60 years, be only two-thirds of the quantity according to Mr. Salmon's distance, yet I suppose it will be generally thought an ample produce and sufficiently encouraging.

According to Table VI. which is calculated for oaks, the first thinning is at sixteen years old, and the second at twenty, but it is the advice of an eminent planter, (Mr. Pontey,) to begin thinning at about thirteen years old, according to the state of the trees, and to cut out about 150 poles per acre annually, for the next seven years. Without putting any value upon the thinnings before 20 years old, we find that at the 20th and 24th years, the thinnings measure 945 feet, the value of which, at a low estimate, will be sufficient to repay the rent and taxes, of ground of a moderate quality, the expense of plants, planting, and after-management, calculated at 5 per cent. compound interest.

When 28 years old, and at the end of every fourth year following, up to 120, the trees to be cut out of an acre will measure from 495 to 550 feet; but say 500, at 4*s*. a foot, on an average, including the value of the bark; this gives 100*l*. which sum divided by 4, leaves 25*l*. for the produce per acre per annum. This deserves the consideration of those who are inclined to convert young woods into coppices, without leaving a reasonable number of standards.

It may however be said, that as the trees cut out in thinning plantations are the bad thrivers and underlings, their contents will be less than the average; but, if we take their

value at one-half the above estimate, that is, after the rate of 12*l.* 10*s.* per acre per annum at 28 years of age and upwards, even this produce must be thought ample, together with the value of the trees left standing.

Table VI. was constructed chiefly with a view to oaks, their annual increase in circumference varying from $\frac{3}{4}$ of an inch to $1\frac{1}{4}$ inch, the medium of which is 1 inch.

Tables VII. and VIII. were calculated for ash, elm, sycamore, firs, poplars, and other woods of swift growth, their increase in circumference being generally from $1\frac{1}{2}$ to 2 inches annually. If ash trees be found to increase after the rates of Table VII. or VIII. they must be exceedingly profitable, at the high prices now given for that timber. Many other observations might be made on Tables VII. and VIII. but these will readily occur to persons interested in quick growing trees.

An acre of trees increasing after the rate of Table VI. produces in 64 years little more than half the number of feet that another acre produces which increases after the rate of Table VII. and little more than one-third of another, increasing after the rate of Table VIII. in the same time.

In planting with a view to profit, the first object is a long, straight, and clear stem. This is most certainly and speedily obtained by thick planting at first, and not thinning too soon. A kind of competition among the trees is thereby occasioned, each struggling, as it were, to outgrow its neighbour, in search of light, heat, air, and moisture.

This competition must, however, be judiciously moderated by timely thinning; always keeping the trees sufficiently strong in the stem. If they be suffered to stand some years too near each other, their stems will become weak, and bend under their small tops when thinned.

Where

Where this has taken place in only a small degree, they will make but little progress for some years afterwards.

By the time the trees have advanced to 24 or 30 feet high this competition should cease, if they are intended to be cut down at or before 60 years of age, and they should then be encouraged to extend their tops more in width than in height, strong side branches being apparently quite as conducive as the leading shoot, to the vigorous growth of the bole below them. After this period, the best rule for thinning will probably be, to leave a clear space around the top of each tree, in which the branches may extend themselves without obstruction. A tree whose top is 20 feet diameter, receives four times the benefit from air, rain and dew as another does whose top is only 10 feet diameter.

The trees in the interior of young woods are smaller in their boles than the exterior trees. And in a fine oak wood, of about 40 acres, divided into squares by several avenues or ridings crossing each other at right angles, I observed the rows of trees next the avenues much thicker in their boles than the trees in the interior of the squares; owing, no doubt, to their having more and larger branches in consequence of their having more room, although it is only on one side.

Being too parsimonious of ground seems to me a great and very general error. If the same number of trees of 32 feet high and upwards, in Table VI. were allowed the space of two acres instead of one, and, in consequence of their standing thinner, were to increase annually only the fiftieth part of an inch more in girt than they would do if they stood on one acre, this small additional increase in girt would pay an ample rent for the additional acre.

In the year 1791 a paper of Observations on the Propagation and Management of Oak Trees in general, but more particularly applying to his Majesty's New Forest in Hampshire, was published by T. Nichols, Purveyor of the Navy for Portsmouth Dock-yard.

In this paper it is said, that "there are to be seen in many parts of the forest from 40 to 50 fine oaks standing on an acre that will measure one with another two loads a tree."

"Several woods in the forest are almost ruined for want of thinning, and its being done at proper times; particularly the inclosures that were made in the year 1700; —these were originally well planted, and great numbers of trees brought up in them, which now remain so close together that they are nearly stagnated, particularly in Salisbury, Trench, Brimley Coppice, and Woodfidley; and, although it is 90 years since they were planted, the trees will not measure, one with another, above six or seven feet a tree; whereas, if the business of thinning had been done as it ought, the remaining trees (after drawing much useful timber) would by this time have been of a size nearly fit for naval uses, as in some of the woods that were planted at the same time, the trees which have had room to expand, and a free air admitted to them, will measure from 70 to 80 feet."

Observations on the Growth of Timber.

The rings observable in the transverse section of a tree at its but-end, are the same in number as the years of its age; an additional ring being produced annually, in consequence of the annual rising of the sap. The rings are nearly concentric

tric in trees that have grown in the interior of close shady woods, but eccentric in others, being of different breadths on the northern and southern sides of such as have grown single, or in any other situation where their boles have been much exposed to the rays of the sun. This difference is occasioned by the different degrees of heat to which the opposite sides of the boles of trees are exposed. And, indeed, we find these rings are always broadest on that side of the bole or stem most warmed by the sun. Hence we see the utility of exposing their boles as much as possible to its rays*. It is often seen in the stumps of trees that have stood single, that they have grown nearly twice as fast on the southern side as on the northern, their pith being so much nearer to the northern side.

It is, however, to be remarked, that the wood from that side of a tree which has grown the slowest, is heavier than from the opposite side which has grown the fastest, and it is probably stronger in the same degree.

It may be worth the consideration of those who have southern hangs or declivities to plant, whether to plant, or rather leave the trees in thinning, in double rows in lines running east and west, at about fourteen or sixteen feet distance, and the double rows at about thirty-six feet distance, less or more, according as the declivity is more or less, in order that their boles may receive the greatest possible benefit from the direct rays of the sun.

No doubt many gentlemen are in possession of facts that

* On a hot day in the middle of May I have observed the mercury in the thermometer to rise and fall from twelve to sixteen degrees, on hanging it alternately on the sunny and shady sides of the same tree, between the hours of two and five o'clock, at which time of the day the heat is generally the greatest.

would

would in some degree ascertain how much faster the boles of trees swell that stand exposed to receive the full benefit of the warmth of the sun, than those that are either partially or constantly in the shade. To make these facts known would materially benefit planters; for I am fully persuaded that there are but few persons apprised of the magnitude of the power of the sun's rays upon the boles of trees in causing them to swell.

Of the most profitable Length of Boles of Trees.

We rarely see timber trees pruned, and still more rarely do we see the pruning performed in a judicious manner. This business should commence early, never suffering the branches on the intended stem or bole to grow to a large size, in order that, when cut off, the wounds may be small and soon healed. Those who want directions for performing the operation, may think it well to consult Mr. Pontey's Forest Pruner. There are, however, divers opinions as to the most profitable height to which trees ought to be pruned, and the instruments most proper for pruning; some persons objecting to the use of the saw, unless afterwards smoothed by the knife; and not a few objecting to pruning in any way, the consequence of which is, that we often find trees that stand single, particularly oaks, with boles not more than six or eight feet high, but with wide spreading bushy tops, fit only for the fire. The shade and drip of one such tree is sometimes found to do more injury than four well-trained trees, and perhaps it is not of half the value of one of them. On the contrary, trees in close plantations are often suffered to stand so much too thick as to destroy each other's branches, excepting only a few small

small ones near their tops; and not unfrequently we see tall elms trimmed up to within a few feet of their summits—it is certain that such trees must swell very slowy in their boles; for we find in woods where the trees are all of the same age, that those with the largest tops have generally the thickest boles.

There is no doubt a medium length of bole for different kinds of trees on different soils, that will be found productive of more timber, or timber of more value, than boles that are much longer or much shorter. And although we may not be able previously to decide with certainty what that exact length of bole is, in any kind of trees, on any soil, which will eventually prove most profitable, yet it is deserving of investigation, if we can thereby approach with certainty to within a few feet of the exact point. It is certainly a matter of too much importance to be left, as it generally is, to each individual woodman to decide upon, according to his own vague opinion. I shall, therefore, take the liberty of stating by what steps I have endeavoured to approximate towards the most profitable lengths of boles of trees of different rates of growth, that are not intended to stand beyond the age of sixty years.

In the preceding tables the trees are supposed to be measured to the top of the leading shoot, but in the following tables only to the height of their boles of 24, 32, and 40 feet.

TABLES

TABLES *showing the Increase of* BOLES *of* TREES *of different Lengths.*

If a tree has increased twelve inches in height and one in circumference annually, until it is twenty-four years old, it will then be twenty-four feet high, and three inches girt at twelve feet high; and supposing that in process of time this tree be pruned up so as to leave the bole twenty-four feet high clear of branches, and that it continue increasing one inch in circumference annually, the rate per cent. per annum of its increase will be as under, exclusive of the increase of timber in its top and lateral branches.

TABLE X.

Years old.	Girt.	Contents.			Years old.	Girt.	Contents.			One year's increase.			Increase per cent. per annum.
	in.	ft.	in.	p.		in.	ft.	in.	p.	ft.	in.	p.	
24	3	1	6	0	25	3¼	1	9	1	0	3	1	17·1
28	4	2	8	0	29	4¼	3	0	1	0	4	1	12·7
32	5	4	2	0	33	5¼	4	7	1	0	5	1	10·1
36	6	6	0	0	37	6¼	6	6	1	0	6	1	8·4
40	7	8	2	0	41	7¼	8	9	1	0	7	1	7·2
44	8	10	8	0	45	8¼	11	4	1	0	8	1	6·3
48	9	13	6	0	49	9¼	14	3	1	0	9	1	5·6
52	10	16	8	0	53	10¼	17	6	1	0	10	1	5·04
56	11	20	2	0	57	11¼	21	1	1	0	11	1	4·5
60	12	24	0	0	61	12¼	25	0	1	1	0	1	4·1
64	13	28	2	0	65	13¼	29	3	1	1	1	1	3·8
68	14	32	8	0	69	14¼	33	10	1	1	2	1	3·5
72	15	37	6	0	73	15¼	38	9	1	1	3	1	3·3
76	16	42	8	0	77	16¼	44	0	1	1	4	1	3·1
80	17	48	2	0	81	17¼	49	7	1	1	5	1	2·9
84	18	54	0	0	85	18¼	55	6	1	1	6	1	2·7
88	19	60	2	0	89	19¼	61	9	1	1	7	1	2·6
92	20	66	8	0	93	20¼	68	4	1	1	8	1	2·5
96	21	73	6	0	97	21¼	75	3	1	1	9	1	2·3
100	22	80	8	0	101	22¼	82	6	1	1	10	1	2·2
120	27	121	6	0	121	27¼	123	9	1	2	3	1	1·8
140	32	170	8	0	14	32¼	173	4	1	2	8	1	1·5
160	37	228	2	0	161	37¼	231	3	1	3	1	1	1·3

But

But if a tree increase 12 inches in height and one inch in circumference annually, until it be 32 feet high, and in process of time the bole be pruned up to that height, the rate per cent. per annum of the increase of this bole will be as under, exclusive of the increase in its top and lateral branches.

TABLE XI.

Years old.	Girt.	Contents.			Years old.	Girt.	Contents.			One year's increase.			Increase per cent. per ann.
	inch.	ft.	in.	pts.		inch.	ft.	in.	pts.	ft.	in.	pts.	
32	4	3	0	8	33	4¼	4	0	2	0	5	6	12·9
36	5	5	6	8	37	5¼	6	1	6	0	6	10	10·25
40	6	8	0	0	41	6¼	8	8	2	0	8	2	8·5
44	7	10	10	8	45	7¼	11	8	2	0	9	6	7·3
48	8	14	2	8	49	8¼	15	1	6	0	10	10	6·3
42	9	18	0	0	53	9¼	19	0	2	1	0	2	5·6
56	10	22	2	8	57	10¼	23	4	2	1	1	6	5·06
60	11	26	10	8	61	11¼	28	1	6	1	2	10	4·59
64	12	32	0	0	65	12¼	33	4	2	1	4	2	4·2
68	13	37	6	8	69	13¼	39	0	2	1	5	6	3·88
72	14	43	6	8	73	14¼	45	1	6	1	6	10	3·6
76	15	50	0	0	77	15¼	51	8	2	1	8	2	3·36
80	16	55	10	8	81	16¼	58	8	2	1	9	6	3·1
100	21	98	0	0	101	21¼	100	4	2	2	4	2	2·39
120	26	150	2	8	121	26¼	153	1	5	2	10	9	1·92

But

But if a tree increase 12 inches in height and one inch in circumference annually, until it be 40 feet high, and in process of time the bole be pruned up to that height, the rate per cent. per annum of the increase of this bole will be as under, exclusive of the increase in its top and lateral branches.

TABLE XII.

Years old.	Girt.	Contents.			Years old.	Girt.	Contents.			One year's increase.			Increase per cent. per ann.
	inch.	ft.	in.	pts.		inch.	ft.	in.	pts.	ft.	in.	pts.	
40	5	6	11	4	41	$5\frac{1}{4}$	7	7	10	0	8	6	10·2
44	6	10	0	0	45	$6\frac{1}{4}$	10	10	2	0	10	2	8·47
48	7	13	7	4	49	$7\frac{1}{4}$	14	7	2	0	11	10	7·2
52	8	17	9	4	53	$8\frac{1}{4}$	18	10	10	1	1	6	6·3
56	9	22	6	0	57	$9\frac{1}{4}$	23	9	2	1	3	2	5·6
60	10	27	9	4	61	$10\frac{1}{4}$	29	2	2	1	4	10	5·05
64	11	33	7	4	65	$11\frac{1}{4}$	35	1	10	1	6	6	4·58
68	12	40	0	0	69	$12\frac{1}{4}$	41	8	2	1	8	2	4·2
72	13	46	11	4	73	$13\frac{1}{4}$	48	9	2	1	9	10	3·87
76	14	54	5	4	77	$14\frac{1}{4}$	56	4	10	1	11	6	3·59
80	15	62	6	0	81	$15\frac{1}{4}$	64	7	2	2	1	2	3·35
100	20	111	1	4	101	$20\frac{1}{4}$	113	10	10	2	9	6	2·51
120	25	173	7	4	121	$25\frac{1}{4}$	177	1	2	3	5	10	2·00

Observations respecting Trees of different Lengths in the Bole.

TREES that increase annually 12 inches in height and one in circumference, and have boles of different lengths, these boles, if of the under-mentioned lengths, increase after the rate

rate of 5 per cent. per annum at the ages and heights undermentioned, and they measure as under, viz.

								Contents.		
			Year's old.		In.		Ft.	Ft	in.	p.
Trees with	12	feet boles at	46	their girt	10	at	6 high,	8	4	0
Do.	16	do.	48	do.	10	at	8 do.	11	1	4
Do.	24	do.	52	do.	10	at	12 do.	16	8	0
Do.	32	do.	56	do.	10	at	16 do.	22	2	8
Do.	40	do.	60	do.	10	at	20 do.	27	9	4
Do.	48	do.	64	do.	10	at	24 do.	32	4	0

Whatever the lengths of the boles of trees increasing as above may be, the increase is 5 per cent. per annum one year after their girt in the middle is 10 inches, but not longer.

But supposing that these trees have grown to 60 years of age, and increased as above-mentioned, their girt and contents at that age would be as under, viz.

								Contents.		
								F.	i.	p.
Trees with	16	feet boles,	13	inches girt at	8	feet	high,	18	9	4
Do.	20	do.	12½	do.	10	do.		21	8	5
Do.	24	do.	12	do.	12	do.		24	0	4
Do.	32	do.	11	do.	16	do.		26	10	8
Do.	40	do.	10	do.	20	do.		27	9	4

This table shows that the advantage to be gained by pruning trees higher than 32 feet, is not an object worthy of consideration, if the trees are to be cut down at the age of 60 years.

And if it should be found that the higher a tree is pruned, the slower it swells in the bole, perhaps a 24 feet bole may measure as much at 60 years old as a 32 feet bole. If it increases half an inch in girt in the last 36 years more than the 32 feet bole increases in the same time, it will very nearly equal it in measure.

A 32 feet bole with a top from 20 to 30 feet high, with many large lateral branches, is certainly a much finer object than a forty feet bole with a top only twenty feet high,

high, with few and small lateral branches: and at sixty years old, the former will have had to increase in the last twenty-eight years, only one quarter of an inch in girt, more than the latter, to exceed it in measure, to say nothing of the excess of timber in the larger top and branches. It must, however, be remarked, that at eighty years of age, the forty feet bole will exceed the thirty-two feet bole nearly six feet; and at one hundred years, thirteen feet, provided it swell equally fast in thickness. But unless the trees be oak, fit for the use of the navy, for which an increased price can be had, I imagine few gentlemen would now choose to let their trees stand to eighty years of age, when the increase of their boles will not be four per cent.; still fewer would let them stand to one hundred, when the increase will not be three per cent. per annum.

Again, let it be supposed that trees sixty years of age have increased annually, during their growth, fifteen inches in height, and one inch and a half in circumference, the girt and contents of their boles, if of the under-mentioned lengths, will be as under, viz.

							Contents. F.	i.	p.
Trees with	20	feet boles, will be	19½	inches girt at	10	feet high,	52	9	9
Do.	25	do.	18¾	do.	12½	do.	61	0	5
Do.	30	do.	18	do.	15	do.	67	6	0
Do.	40	do.	16½	do.	20	do.	75	7	6
Do.	50	do.	15	do.	25	do.	78	1	6

Taking it for granted that the shorter boles will increase faster in thickness than the longer ones, it is reasonable to expect that the forty feet bole will contain more timber than the fifty feet bole when they are both sixty years old; and if they are both sold at the same rate per foot, the forty feet

feet bole must consequently be more valuable. If, however, a higher price can be had for longer boles, this may compensate not only for their deficiency in measure at sixty years of age, but also for their standing beyond the period when they cease paying the common rate of interest for the money they are worth, which I suppose is frequently the case as to tall elm trees, fit for keel pieces, and perhaps beech for ship planking. It is hence evident, that where the soil is such as will enable trees to grow to a great height, it will be necessary, before we decide how high to prune them, to consider to what purposes the timber can be most advantageously appropriated.

Whatever the lengths of the boles of trees increasing as above may be, their increase is five per cent. per annum, one year after their girt in the middle is 15 inches, but not longer.

Again, let it be supposed that trees sixty years of age have increased annually, during their growth, eighteen inches in height, and two inches in circumference, the girt and contents of their boles, if of the under-mentioned lengths, will be as under, viz.

							Contents. F.	i.	p.
Trees with 24 feet boles, will be	26	inches	girt at	12	feet high,		112	8	0
Do.	30	do.	25	do.	15	do.	130	2	6
Do.	36	do.	24	do.	18	do.	144	0	0
Do.	48	do.	22	do.	24	do.	161	4	0
Do.	60	do.	20	do.	30	do.	166	8	0

Here again we may suppose that the forty-eight feet bole, by swelling faster than the sixty feet bole, may exceed it in measure at sixty years of age, and this it would do, were the girt increased only half an inch. And if the thirty-six feet bole was increased two inches in girt, it would exceed

both the forty-eight and sixty feet boles. But trees of such swift growth are frequently cut down before they are sixty years old. At forty years of age the thirty-six feet bole, if it swell no faster than the forty-eight feet bole, will contain more timber if measured according to the present erroneous method. (The greater disproportion there is between the two ends of a piece of timber, and the more disadvantageously it measures, when the girt is taken in the middle.) I suppose that in timber of this swift growth, the longer boles are frequently not worth more per foot than the shorter boles; therefore, in this case, that length of bole should be fixed on which is likely to measure most at the period when the trees are intended to be felled.

Whatever the lengths of the boles of trees increasing as above may be, their increase is five per cent. per annum, one year after their girt in the middle is 20 inches, but not longer.

It appears from the last observations and calculations, that the annual increase in the boles of trees by their growth, ceases to be equal to five per cent. per annum some time between forty-six and sixty years of age, according as the boles are shorter or longer.

But it being generally allowed that oak trees, of a size fit for the navy, require to grow from eighty to one hundred and fifty years, according to the quality of the soil, and it is so stated in the eleventh report of the commissioners appointed to inquire into the state and condition of the woods, forests, and land revenues of the crown; I have therefore been calculating tables, showing what the proportionably advanced prices should be, at different periods, up to one hundred and fifty years, to pay the proprietors for letting their trees stand to those periods. These prices, especially

at

at the later periods, very greatly exceed any that have ever been given. It certainly has been much the interest of the growers of oak timber to fell it at about sixty years of age, even if they replant the same ground. To let it stand to one hundred and twenty years of age, and sell it at the present prices, their loss would exceed double the whole value of the timber at sixty years of age. Nothing short of a sufficient price will long command a sufficient supply. Owing to too low prices the quantity of large timber on private estates has long been rapidly decreasing; and it will be too late to commence offering reasonable prices for it when it is all gone, and no oaks left of greater growth than sixty years. To have to wait their growing the second sixty years, may bring upon us evils exceeding all calculation.

Valuations made in October, 1807, *of several Plantations in Staffordshire.*

The valuations were made of the trees growing within the space of a chain square, being the tenth part of an acre, of the medium growth of each plantation.

In the plantation by the mill wall there are now growing within twenty-two yards square, as under, viz.

	£.	s.	d.	£.	s.	d.
70 oak trees, containing 175 feet, at 2*s.* 3*d.* .	19	13	9			
1200 of oak bark, at 12*s.*	7	4	0			
	26	17	9	or, per acre, 268	17	6

The above is part of about four acres planted in 1775, on a strong loamy soil, worth about 20*s.* an acre.

	£.	s.	d.
One pound per ann. forborn 32 years, and improved at 5 per cent. compound interest, would amount to	75	6	0

But the value of the timber is more than three times this amount.

The ground was prepared for planting by ploughing.

On the east side of Cottage Wood there are now growing, within twenty-two yards square, as under, viz.

	£.	s.	d.		£.	s.	d.
50 ashes, containing 300 feet, at 1*s.* 6*d.*	22	10	0				
13 oaks do. 7 do. 2*s.*	0	14	0				
Bark	0	7	0				
	23	11	0	or, per acre,	235	10	0

The above is part of about two acres planted in 1776, partly on heaps of earth in clay pits, and partly on strong soil upon a deep bed of sand, value about 15*s.* an acre.

	£.	s.	d.
Fifteen shillings per annum, forborn 31 years, and improved at 5 per cent. compound interest, would amount to	53	0	0

But the value of the timber is more than four times this amount.

In the clay pits only holes were dug for the plants, but the other part wholly trenched, or double dug with the spade.

In Pickmore Pool Plantation there are now growing, within twenty-two yards square, as under, viz.

	£.	s.	d.		£.	s.	d.
97 Scotch firs, containing 636 feet *, at 1*s.*	31	16	0	or, per acre,	318	0	0

* This produce is after the rate of 6360 feet an acre, which is about the rate of Table IV.

The

The last plantation is part of about six acres planted in the springs of 1778 and 9. Much of the soil is a tough peat on gravel or hungry white sand, worth, say 5*s.* per acre.

This ground laid between two tenants who had never cultivated it. They had then nineteen years unexpired of their lease of thirty-one years of this and the adjoining lands, and willingly gave it up to be planted, on condition of having the fences made and kept in good repair.

	£.	s.	d.
Five shillings a year, forborn 29 years, and improved at 5 per cent. compound interest, would amount to	15	11	0

But the value of the timber is more than twenty times this amount.

The trees were about two feet high, and planted at two yards distance, in holes dug with the spade, 1210 on an acre. Labour of making the holes and planting the trees cost 1*l.* 6*s.* 10½*d.* per acre.

About 2700 were planted on an acre in the other plantations, where the ground was wholly broken up.

In the remarks on these three plantations, no notice is taken of the thinnings. I am informed by gentlemen who have kept accounts of thinnings, that these have repaid the rent of the land and every expense, with compound interest, some time before the woods were thirty years old; and the preceding calculations show that it may be so. And if so, the present value of these plantations is all clear gain.

The valuer of these plantations has bought a good deal of wood out of them; and the prices he has valued at per foot, may possibly be a fair value there for such small timber.

The growth of the firs in the last-mentioned plantation, is probably as great in that poor ground as it would have

been had they been planted on ground of three or four times its value; this must be a powerful inducement to gentlemen to plant all such poor ground in the first instance.

And a few of oaks, ashes, and firs, may be raised on almost every farm in screens, that may, by their shelter, increase the value of the farm to the occupier, by increasing the produce, particularly that of grass grounds. In this case the interest of landlord and tenant may be reciprocal; but it is the reverse where trees are planted in hedge-rows.

And even the sides and tops of high mountains may be made abundantly more productive of grass, if certain portions of them were surrounded by plantations. These plantations, by breaking the force of cold winds, diminish their chilling effect on the fields the plantations surround, and render the climate on mountains much more mild and genial.

This last kind of improvement will generally be found very greatly to exceed the expectation of the improver, provided it be judiciously planned and executed.

May I take the liberty to suggest, that information of very great value might be obtained by the Society from the gentlemen to whom medals and premiums have been given for planting trees, if they would favour the Society with their subsequent observations respecting those plantations.

It would, for instance, be desireable to have the nature of the soil and under strata described,—the sorts of trees best suited thereto,—the distance at which the trees were first planted,—at what periods they were thinned, and how many cut out at each thinning, and their measure and value,—the present height, distance, measure, and value, of the trees now growing on an acre,—what distances are found

found most advantageous, and also the best height to be pruned.

The fund of information that such communications might afford, would prove of very great value indeed to future planters, as well as to many proprietors of plantations of different ages now growing.

If the Society should think it adviseable to solicit this information, no doubt the ample and valuable materials they would thereby obtain, would enable some abler pen to do justice to the curious and important subjects of the preceding pages. In the mean time it is hoped, that this attempt to reduce our knowledge of the growth of timber to something like system, however imperfect it may be, will be received with indulgence. Assuredly, it had not so soon seen the light, had not the present situation of our country imperiously demanded of every individual his utmost exertion to render us as independent as possible of supplies of every kind from the continent of Europe, from which we are now almost totally excluded.

C. WAISTELL.

High Holborn, March 15, 1808.

To CHARLES TAYLOR, M. D. SEC.

The GOLD MEDAL *of the Society was this Session voted to* JOHN CHRISTIAN CURWEN, *Esq. M. P. of Workington-Hall, Cumberland, for his Improvements in the* CULTURE OF VEGETABLES. *The following Communications were received from him.*

SIR,

I AM fearful you should suppose that I am become indolent, and that the favours so liberally bestowed on me by

the Society, had ceased to operate as a stimulus to the further exertions of my humble endeavours to assist those objects which, by the fostering hand of the Society, have been so essentially promoted. You will excuse me for wishing to assure you that I am not idle, and to inform you that the objects which at present employ me are, I conceive, of great importance to agriculture.

The first is by experiments to ascertain the best and most productive mode of applying manure. The second is to determine whether the distances between the stitches in drill husbandry may not be greatly enlarged, without any diminution of crop.

I am strongly inclined to believe that where the ground is laid dry, that manure can scarcely be deposited too deep; by so doing the evaporation is retarded, and consequently the manure continues for a greater length of time to furnish nourishment to the crop.

The increase of the distances between the stitches, permits the power of continuing the operations of turning up the soil to a more extended period, which not only improves the tilth, but furnishes a greater degree of moisture by exhalation, than can be yielded from ground in that state of hardness it soon acquires when undisturbed in summer. This evaporation is prodigious, though not perceptible to the eye: it is, however, fully demonstrated by a very ingenious experiment of the Bishop of Llandaff; and I am anxiously expecting to form such conclusions from trials I am engaged in respecting its effects on vegetation, as may deserve the consideration of the Society.

My former objects of feeding cattle with potatoes, supplying milk to the poor, &c. are pursued with increased

success.

success. The use of potatoes as a food for horses and cattle increases daily.

I am, dear Sir,

Your faithful and obedient Servant,

J. C. CURWEN.

Illetson's Hotel,
London, April 21st, 1807.

To Charles Taylor, M. D. Sec.

Dear Sir,

It is with great satisfaction that I have the honor of again submitting the result of my farming operations to the consideration of the Society of Arts. Deeply impressed with a sense of the many favors conferred upon me by them, I have found myself impelled, both by gratitude and inclination, to proceed with redoubled exertion, as the best return in my power.

The liberal patronage and encouragement bestowed on agriculture by the Society, has powerfully contributed to awaken the country to a just estimation of its importance, as the basis of individual happiness and national prosperity; and at this moment the empire owes its preservation and security to it.

I submit with great deference the result of my recent operations. I am disposed to flatter myself that they may lead to important consequences and discoveries, highly beneficial to agriculture. The experiments I have made tend to establish the double advantage of well cleaning and working the ground. First, as it frees the land from weeds; and secondly, as it conduces to the growth of the crop. It affords

affords likewise a very strong demonstration in favour of using manure in its freshest state, by which not only the great usual expense of making dunghills will be saved, but the manure made to extend to the improvement of a third more land.

Most of the farm I occupy was in that state of foulness as to require, according to general practice and opinion, a succession of fallows to clean it. Being unwilling to adopt a system which is attended with such loss, I determined to attempt to clean a part of it by green crops, and for such purpose to allow a much greater distance between the stitches than had ever been in practice. My first experiment on this plan was made on a crop of cabbages; they were planted in a quincunx form, allowing four feet and a half between each plant, in order to allow room for the plough to work in all directions. I adopted this plan of field husbandry, as affording the greatest facility in cleaning the crop, though I believe it never was before so practised. Two thousand three hundred and fifty plants were set per acre (eight thousand is not unusual in the common method), and each plant had, by computation, an allowance of a stone of manure, or less than fourteen tons per acre; though the common quantity is generally from thirty to forty tons per acre. The manure was deposited as deep as the plough could penetrate, drawn by four horses, and the plant set directly above it.

The plough and harrow constructed to work betwixt the rows, were constantly employed during the summer, and the ground was as completely freed from weeds as it could have been by a naked fallow. The very surprising weight of my crop, which in October was thirty-five tons and a half per acre, and many of the cabbages fifty-five pounds

each,

each, were matters of surprise to all who saw them, as well as to me, and I could assign no satisfactory reason for the fact. The quality of the land was very indifferent, being a poor cold clay,—the manure was very deficient of the usual quantity,—the plants when set by no means good,—in short there was nothing to justify the expectation of even a tolerable crop. I did not find any thing in the accounts from cultivators of cabbages to afford me a solution of my difficulties, or any clue to explain it. By mere accident I met with the Bishop of Landaff's experiment ascertaining the great evaporation from the earth, as related in his admirable Treatise on Chymistry; singular as it may appear, this very interesting experiment had remained for thirty years without any practical inferences being drawn from it applicable to agriculture. It appeared to me highly probable, that the rapid advance in growth made after the hoeing of drilled grain, was attributable to the absorption of the evaporation produced from the earth, and was the cause of the growth of my cabbages. With great impatience and anxiety, as I had the honour to inform you last year, I looked forward to the ensuing season to afford me an opportunity of continuing my experiments. I had long been a strenuous advocate for deep burying of manure, though my sentiments rested chiefly on opinion; this appeared to open a field for incontestible proofs of its advantage. My cabbages were last year planted on the same plan as the former year. Fortunately I extended the same principle to my potatoes, which I was obliged to set on wet strong ground, from want of a choice of land. My annual quantity of potatoe ground is from sixty to seventy acres. They were set in beds three feet long and two feet broad, leaving four feet and a half between each bed lengthways, and three

feet

feet endways. On each acre there were 1230 beds, and 6150 sets, or five to each bed, viz. one at each corner, and one in the middle. The sets of potatoes, when planted according to the usual most approved practice, in three feet stitches, and nine inches apart, amount to about twenty thousand. In the present, and indeed in all seasons when potatoes are scarce, the saving in planting is a considerable object. A great advantage also arises in being able to keep the potatoes and manure from wet. In the late uncommonly wet season I sustained little or no loss in my mode, which was not the case in many of the driest grounds. This plan unites hand hoeing with horse culture, and will be found serviceable in wet soils.

The lateness of planting, together with the premature frosts, prevented my forming a fair judgment as to the quantity per acre which might be obtained by this method. My view in fixing upon this plan was, to enable me to judge of the effects of evaporation, by being able to continue my operations for a longer period. I have no doubt but that in common seasons, notwithstanding the increased distance, the whole ground would be covered.

My experiments on cabbages this season commenced by planting them early in April. From the rain which fell subsequently, and continued till the beginning of May, succeeded by severe east winds, the earth became so hard and baked, that the plants had made very little progress.

In the first week in June the ploughs were set to work: as they started, Mr. Ponsonby of Hail Hall was present, and saw the crop; it was with difficulty that the ground was first broken, but by the end of the week it was brought into fine tilth. Notwithstanding the whole week had been dry, with a strong sun and severe east wind, yet such was the

the progress in growth of the cabbages, that when seen again by that gentleman on the Saturday, he could scarce be persuaded they were the same plants.

In these operations I had been making constant experiments with glasses, contrived for the purpose, to ascertain the quantity of evaporation from the land, which I found to amount, on the fresh ploughed ground, to nine hundred and fifty pounds per hour on the surface of a statute acre, whilst on the ground unbroken, though the glass stood repeatedly for two hours at a time, there was not the least cloud upon it, which proved that no moisture then arose from the earth.

The evaporation from the ploughed land was found to decrease rapidly after the first and second day, and ceased after five or six days, depending on the wind and sun. These experiments were carried on for many months. After July the evaporation decreased, which proves that though the heat of the atmosphere be equal, the air is not so dense. The evaporation, after the most abundant rains, was not advanced beyond what the earth afforded on being fresh turned up. The rapid growth of my potatoes corresponded perfectly with the previous experiments; and their growth in dry weather visibly exceeded that of other crops where the earth was not stirred. The component parts of the matter evaporated remain yet to be ascertained; the beneficial effects arising from it to vegetation cannot be doubted or denied, but whether they proceed from one or more causes, is a question of much curiosity and importance.

May not a similar process here take place, as when water is exposed to the action of the air in irrigation? Is it too much to suppose some natural operation to take place in the earth, which may decompose the oxygen contained in

air

air from the hydrogen, during the absence of the sun, which on the sun's re-appearance may be again given out in a state highly propitious to vegetation? Oxygen is found to contain carbon; and may not the growing plants imbibe it from the air, and may we not thereby account for its forming a constituent part of all vegetables?

The investigation of these objects presents a wide field for inquiry, and may lead to very important discoveries. From more or less oxygen contained in the earth, may not its proportions account for the fertility of one soil above another? May not the advantages supposed to be derived from loosening the soil, proceed from its being thus rendered in a fit state to imbibe the air? Fallows soon become so hard upon the surface, as neither to be capable of absorption or evaporation. One very important result is placed before the eyes, and within the reach of every practical agriculturist to ascertain, namely, that the evaporation from dung is five times as much as from earth, and is equal on the surface of an acre to 5000 pounds per hour. By making use of dung in its freshest state, the farmer may extend his cropping to one third more land with the same quantity of manure. It is with regret that I have viewed in many parts of the kingdom the quantity of manure which is exposed on the surface, and tends to no good. I am strongly of opinion that in all light soils, if the manure was buried in trenches as I propose, and the turnips sowed above it, that more abundant crops would be procured. By cleaning with the plough, great advantage would be derived to the crop, from the evaporation yielded by the earth. Hot manure might also be used. By fermentation dung is reduced to one half its bulk, and its quality reduced in a much greater proportion. The manure now commonly

monly taken for one acre of broad cast, would, if deposited whilst hot in drills, answer for four acres, and the crop produced be much more.

If the Society of Arts extend their sanction and patronage to my exertions, I shall feel bound to proceed, and to endeavour to bring the experiments to a regular system. The glasses I used for determining the quantity of evaporation were of a bell form, and placed with the open part upon the earth; a quantity of tow was first weighed, ready to wipe off the moisture collected from evaporation within the glass, which tow was then again weighed as exactly as I could after the glass had stood for a given time, and been wiped dry with the tow; and from knowing the contents of the glass I made my calculations. Mr. Robert Wood, watch-maker, of Workington, attended to the experiments made with the glasses.

I have the honour to be, with great respect,

Dear Sir,

Your obedient humble servant,

J. C. CURWEN.

Workington Hall, Jan. 9, 1808.

To C. Taylor, M. D. Sec.

Dear Sir,

It is with great pleasure and satisfaction that I learnt yesterday from Mr. Arthur Young, the Secretary of the Board of Agriculture, that he has adopted my idea of the great importance of evaporation, and that he has actually ordered

ordered Mr. Blunt, optician, of Cornhill, to construct him an instrument for ascertaining the evaporation, which instrument I shall request Mr. Blunt to show to the Society. Mr. Young intends in the course of the summer to make a variety of experiments on the quantity of evaporation produced from different soils, agreeing with me, that the greater or less degree of it influences most materially the luxuriance or growth of the crop.

In all the valuable tracts which Mr. Young has given to the world, he has never adverted to this, and the first knowledge of it as a principle for promoting the growth of crops, was obtained from my account of the Schoose Farm, in the report of the Workington Agricultural Society, of which he is a member.

Being unable to account for the surprising weight of my first crop of cabbages, with only one-third of the manure usually given, I was led to make the experiments I have laid before the Society; and I believe I am not only the first person in Lancashire, but even in Great Britain, who ever thought of ploughing the ground upon the principle I have executed, for promoting the growth of the crops. I flatter myself that my experiments on the economical application of manure, will lead in a high degree to facilitate a more extended cultivation, and obviate the objections which have been started by some persons against the inclosure of waste lands, from their supposition that manure could not be furnished for more than the land at present cultivated. I remain, dear Sir,

Your obedient Servant,

J. C. CURWEN.

Ibbetson's Hotel, Vere-street,
April 8th, 1808.

To C. Taylor, M. D. Sec.

Cer-

CERTIFICATES.

A Certificate from Miles Ponsonby, Esq. of Hail Hall, testified that he had seen Mr. Curwen's statement of the rapid progress made by his cabbages in the month of June 1807; that he perfectly recollects viewing them on the Monday, and again on Saturday in the same week; that the improvement in the appearance of the plants was so great, that he imagined the land had been replanted, till Mr. Curwen explained the cause which had produced so great a change.

That he considers Mr. Curwen's plan of managing his potatoes and cabbages as very good garden husbandry, and the best calculated for keeping the land clean, improving the plant, and at the same time enriching the ground, of any that he had observed; and though the mode is entirely new there, he has no doubt but it will be found beneficial, and that it will in a few years be much attended to.

A Certificate from Mr. D. Campbell, Secretary to the Kendal Agricultural Society, stated, that he had attended to the cultivation of potatoes in most parts of Lancashire, and could speak with the greatest precision respecting it in that part of the county, which is north of Lancaster.

That whether they were planted in the lazybed way, by the dibble, or with the plough, they were always set in *rows* from *one end of a field*, or *piece of ground*, to *the other end or side*, with narrower or wider intervals, as the cultivator might deem best suited to the kind of potatoe he was raising. That he never before saw or heard of their being cultivated in beds, in the manner practised and described by Mr. Curwen, and that being more particularly desirous to ascertain whether any such method was pursued in the great potatoe district which lies south-west from Lancaster,

including Pilling, the Felde, Rufford, and the neighbourhood of Preston, he applied to George Clayton, Esq. of Lostock Hall, and Robert Hesketh, Esq. of Warrington Hall, gentlemen upon whose accuracy the utmost dependance may be placed, and who informed him, that neither from their own knowledge, nor from inquiries they have made, can they learn that the method of cultivating potatoes alluded to, has been seen or heard of in a tract of country, where more are raised for the market than in any other of the same extent perhaps in the kingdom.

Mr. Campbell further stated, that Mr. Curwen's cabbages were planted at a much greater distance than any he had ever before seen, and their size far exceeded, as a general crop, any that had fallen under his observation; that the ground was perfectly clear from weeds, and from having been frequently turned over by the plough in the intervals, the mould appeared to be in fine order for a subsequent crop, and he conceived that in the two essential points of freedom from weeds, and of the land being in a fine tilth, no garden could exceed it.

Other Certificates respecting the novelty of the method of planting potatoes, as practised by Mr. Curwen, were received from the following gentlemen:

WILLLIAM KNOTT, Summerhill.
MR. SUNDERAND, Ulverston.
J. PENNY MARSHALL, Bolton Oak.

Further Certificates, stating the method to be new, as practised by Mr. CURWEN, for planting both potatoes and cabbages, were received from the following gentlemen:

WALTER GARDNER, Crooks.
WILLIAM HARRISON, Ulverston.

A. BENSON,

A. Benson, Reading.
Henry Richmond Gale, Bardsee Hall.
Jos. Penny, Budgefield.
Edward Barrow, Allithwaite Lodge.
Charles Gibson, President of the Lancaster Agricultural Society.
Rev. J. Barns, Pennybridge.
Rev. E. Ellerton, Colton.
Jos. Yorker, Ulverston.
Michael Knott, Thurstonville.
Rev. Joseph Brooks, Ulverston.
Thomas Machell, Aynsome.

Also from the following Farmers, resident in the neighbourhood of Lancaster:

Thomas Tart.
William Armstead.
William Staller.
Anthony Eidsforth.
Christopher Atkinson.
Robert Edmondson.

Dear Sir,

Mr. Curwen having informed me, that a question would probably arise in the Society of Arts, &c. relative to the degree of exhalation of water from the earth, and it appearing to me to be intimately connected with various matters in agriculture, I think you will not be displeased at my mentioning a few circumstances, to prove that the object much deserves attention. I conceive that it bears upon

the point of showing the great depth to which dung may be ploughed with safety; for when we find, as I have done, that from two to three thousand gallons of moisture are exhaled in a day from an acre of land, and that the quantity varies greatly according to the state of tillage, it should appear that such a vertical stream of vapour must remove all apprehensions of *burying* dung. I also think it goes to the point of hoeing and horse-hoeing such plants as demand much moisture. I have found that the dung in a farm-yard, laid three feet deep and hard trodden by cattle all the winter, has exhaled in the proportion of above four thousand gallons per acre in ten hours; from hence a practical conclusion may be surely drawn. I could much extend these observations, but they are sufficient to convince so enlightened a mind as yours of the propriety of a very extensive pursuit of this inquiry.

I have the honour to be,

With much regard, dear Sir,

Your faithful and very humble Servant,

ARTHUR YOUNG.

Board of Agriculture, May 6th, 1808.

To C. Taylor, M. D. Sec.

The

The GOLD MEDAL *of the Society, being the Premium offered for the comparative Culture of Wheat, was this Session adjudged to* ROBERT BURROWS, *Esq. of Great Witchingham, Norfolk, from whom the following Communications were received.*

SIR,

I BEG you will have the goodness to communicate to the Society of Arts, &c. for their approbation, the following result of an experiment upon the comparative culture of wheat, conducted with a view of meeting the wishes of the Society upon the subject; and with that accurate impartiality which I trust will go far towards establishing (especially upon such sort of soils as those on which the experiment was made), that necessary, and among agriculturists, long-agitated question, respecting the best method of depositing the seed of that truly useful and valuable grain.

You will perceive, by the accompanying papers, that my experiment partakes of a twofold nature, having repeated it under two different preparations of the land: first, a clover stubble; a preparation for wheat well and deservedly known in almost every part of the kingdom. The other is a mode of preparing the land for wheat, perhaps, rather peculiar to some districts of this county, and is known by the name of a bastard fallow; and which I shall describe in its proper place. In each instance of trial, I have thought it best to exclude entirely the use of manure, deeming it not unlikely, that though the quantity of manure employed upon

the occasion might be exactly proportioned, yet it was not improbable but that there might be some little difference in the quality of such manure so employed; especially when it is considered, that a very large heap of dung or compost was required to spread over the surface of twenty-four acres of land. Under that impression, I chose rather to trust to the previous good condition the land was already in, having for the four preceding years treated both fields exactly similar; and when under turnips two years before, the crops in both fields were two-thirds of them fed upon the land with both sheep and cattle.

I have likewise sent, for the Society's inspection, respective samples of the grain grown, together with specimens of the soils of each field in which the experiments were made, judging the latter step necessary, in case my description of the soil may not be perfectly and clearly understood. The Society, if they think proper, may avail themselves of a chymical analysis thereof.

I have the honour to remain, Sir,

Your most obedient humble Servant,

ROBERT BURROWS.

Great Witchingham, near Norwich,
January 28, 1808.

To C. TAYLOR, M.D. SEC.

The

The following is the Account of an Experiment on the comparative Culture of Wheat, made in the Year 1807, *by* ROBERT BURROWS, *of Great Witchingham, in the County of Norfolk.*

Clover Stubble Experiment.

In the autumn of 1806, I set out by the chain twelve statute acres of land in the middle of a field, containing by survey twenty-six acres; I again divided the twelve acres into subdivisions of four acres each: the soil, a deep sandy loam, tolerably rich, and what in the county of Norfolk is usually termed, an excellent turnip soil. I considered myself as extremely fortunate this year, in being able to appropriate to the experiment a portion of land so exactly similar in regard to quality of soil, as is not often to be met with in this county, where lands in some of the best districts are remarkable for varying materially, even in the same field, especially if that field is of any considerable extent. With so favourable an opportunity as the present, in the middle of a large field, without a tree, or even an hedge-row of sufficient height to have any injurious influence over my future crop, I commenced with considerable eagerness an experiment I had long been desirous of bringing to a crisis, and which I had twice before begun, and as often, from the interference of local circumstances, been obliged to abandon.

On the 22d of September 1806, and the two following days, I commenced the experiment, by ploughing the whole

twelve acres nearly six inches deep, laying the same into stitches of ten yards in the breadth, which, as the soil was perfectly dry, I considered stitches that width the most convenient for the different operations I was about to perform. Upon the 25th of the same month I sowed the broadcast, two Winchester bushels per acre, harrowing in the seed immediately after, two, three, or more times in a place, until the whole or nearly the whole of the seed was buried. Such few remaining grains as were still uncovered I pressed into the earth, by causing a heavy roller to pass over the ridges the same way they were ploughed; an operation considered highly beneficial upon loose pulverised soil after seeding them, as the roller not only compresses the soil, but, in the case of broadcast particularly, it buries sufficiently deep in the earth for them to vegetate, (such grains as may have escaped the harrows,) and which, but for this operation, would become a prey to rooks and other birds; likewise, if the rolling is well performed, it prevents the seeds of a variety of weeds from vegetating.

On the same day the broadcast was finished, I employed three men to dibble the four acres on one side of the broadcast already sown. They began and finished the dibbling upon that and the two following days, in equidistant rows of four and a half inches asunder—the usual method of dibbling practised in the county of Norfolk, and which general method I thought necessary to adhere to in the present experiment. Two such rows upon a furrow nine inches wide, and the holes three inches apart from each other, or, upon an average, four holes to a foot measure, is considered as equivalent to one now drilled by Cooke's

machine

machine upon the same sized furrow. Three children follow one man, dropping the grain from two to four in each hole. The quantity of seed made use of upon this occasion was exactly six pecks per acre. At the time the dibbling was going on, two men and a boy, with Cooke's drill machine, drilled the four acres on the other side of the broadcast, in equidistant rows of nine inches,—a distance, perhaps, to be preferred to all others in drilling: for, if the space between the rows is less than nine inches, the horse-hoe can scarce be used with safety; and without the use of the hoe, drilling can only be called imperfect husbandry: and though, in the experiment which I am here detailing, drilling has only turned out second best, yet I am so well persuaded of its being an excellent practice on many kinds of soils in various parts of the kingdom, that I should be sincerely sorry to see the active and intelligent farmer reject it from his system of husbandry. For my own part, though the present result is contrary to my expectation, yet I shall not dismiss the drill from my farm, nor cease to use it even in depositing my future wheat crops. The quickness and ease with which the business of wheat sowing is performed; the completeness and facility with which weeds of various kinds may be eradicated, together with the neat and garden-like appearance of a crop under the drill system, will ever be with me powerful persuaders to its use; and perhaps, even in the present instance, its failure may properly be attributed to the loose and pulverised nature of the soil; which, rather than loosen still more by the frequent operation of horse-hoeing, ought to have been compressed by the feet of sheep or neat cattle, or by rolling, in those early spring months when the plants begin to tiller

on the surface of the earth. The quantity of seed drilled upon the last four acres was exactly six pecks and a quarter per acre: the seed wheat made use of upon such occasion was the old Kentish red.

After having made a few observations upon the state and appearance of the crop under experiment, at various times between seeding and harvest, I shall then proceed to a statement of the expenses of cultivation, and an account of the produce. I shall afterwards consider the fallow experiment by itself, in the same manner as I have done the present; beginning with the state and preparation of the soil, the time and method of seeding, &c.

A few days after the various operations of dibbling, drilling, and sowing, were completed, the wheat in each instance made its appearance; the broadcast first, as probably that was not buried so deep in the earth as in the other two divisions, nor at such even distance from the surface: after the broadcast, the dibbled came up; and last of all the drilled, which latter, when all three were completely above ground, looked much more regular and beautiful than either of the others. From being sown early, the frosts of the winter never entirely destroyed their green verdure. During the winter season the broadcast, owing probably to its being thicker upon the ground, seemed to have the advantage in point of appearance, and maintained the same until the beginning of the month of March, when the drilled began to assume a very apparent superiority, by exhibiting a fine dark green hue, together with a broad reedy leaf. This decided advantage it maintained the greater part of the summer, until, having fully shot the ear, the whole field were one general appearance and colour. Next to the drilled,

drilled, the dibbled greatly exceeded the *broadcast* in point of health and promise; the latter, particularly towards the end of the month of May, lost its colour very fast, and looked rather pale and sickly throughout the rest of the summer. The circumstance of its looking more pale and sickly than either of the other two divisions, I could only attribute to its being too thick to admit a proper circulation of air between the plants, which I consider as one of the evils of broadcast crops: however, though aware that such might be the case, I conceived it necessary, in order to render the experiment useful and complete, to use, as near as I could, the same relative proportions of seed as are thought requisite by intelligent and practical farmers in general.

In stating the expenses, I shall forbear saying any thing of the rent, parochial rates, &c. attached to the land: as they are the same in each instance, and vary perhaps in their nature in different districts in the kingdom: as such, I shall leave individuals to apply them to their own particular situations, whilst I confine myself to such immediate expenses as attended each individual method from the time of seeding to the time of reaping the same, beginning in the order I have described them above.

Expenses of four Acres of Broadcast Wheat.

		£.	s.	d.
Seed, eight bushels, at 8s. per bushel	-	3	4	0
One man half a day sowing the same	-	0	1	0
Carried forward,	£.	3	5	0

Harrowing

	£.	s.	d.
Brought forward,	3	5	0
Harrowing, two horses one day, with a lad attending the same - - -	0	5	9
Rolling the four acres, two horses with a lad ½ a day	0	2	10½
Ploughing the land once, at 5s. per acre -	1	0	0
The season of spring being remarkably wet, brought up many weeds of various kinds, particularly the red poppy, a species of weed the field, where the experiment was made, was much subject to. Here will appear, under such circumstances, the advantage of horse hoeing, which will be found materially to lessen the expense of weeding, which, in crops not planted in regular rows, must be eradicated either by the small hand-hoe, or by the hand only; and which methods were resorted to in the present broadcast crop, and done principally by women; the expense 8s. 8d. per acre - - - -	1	14	8
Reaping four acres at 8s. 6d. per acre -	1	14	0
Threshing and carrying to market fourteen quarters two bushels and half a peck -	2	2	9½
Expenses of cultivating four acres of broadcast wheat - - -	£.10	5	0

Produce of four Acres of Broadcast Wheat.

	£.	s.	d.
Fourteen quarters two bushels and half a peck, sold to the merchant at 64s. per quarter -	45	13	0
Value of the straw grown upon the above four acres of broadcast wheat, per acre two tons one hundred weight eight pounds, making in the whole			

eight

	£.	s.	d.
eight tons four hundred weight two stone four pounds weight of straw, consumed, by covenant of lease, upon the farm; yet in the present instance I shall estimate the straw at the price given at the nearest market, Norwich, where straw is now selling at 3s. per hundred weight -	24	12	10
Value of the produce of four acres - -	70	5	10
Expenses of cultivating the four acres of broadcast wheat - - -	10	5	0
£.	60	0	10

Weight of the grain, per Winchester bushel, as weighed at the time of sale, sixty-one pounds.

Expenses of Dibbling four Acres of Wheat.

	£.	s.	d.
Seed, six bushels, at 8s. per bushel - -	2	8	0
Ploughing the land, at 5s. per acre -	1	0	0
Rolling the land before dibbling, a lad and two horses half a day - - -	0	2	10½
Dibbling four acres, at 10s. per acre -	2	0	0
Bush harrowing to bury the seed, one horse and boy half a day - - -	0	1	7½
Weeding, four women four days hand-hoeing, at 8d. each day - - -	0	10	2
Do. four women again two days, second time of hand-hoeing - - -	0	5	1
Do. three women two days, drawing by hand what escaped the hoes - - -	0	4	0
Reaping the four acres, at 8s. 6d. per acre -	1	14	0
Carried forward, £.	8	5	9

Threshing

	£.	s.	d.
Brought forward,	8	5	9
Threshing and carrying to market seventeen quarters one bushel and a half of wheat -	2	11	$6\frac{3}{4}$
Expenses of cultivating four acres of dibbled wheat £.	10	17	$3\frac{3}{4}$

Produce of four Acres of Dibbled Wheat.

	£.	s.	d.
Seventeen quarters one bushel and a half of wheat carried to market, at 61s. per quarter -	55	0	0
Value of the straw upon the four acres of dibbled wheat, estimated as in the foregoing experiment, two ton two hundred weight four stone per acre, on the whole, eight tons ten hundred weight, at 3s. per hundred weight, the price at Norwich	25	10	0
Value of the produce of four acres of dibbled wheat	80	10	0
Expenses of the cultivation of four acres of dibbled wheat - - - - -	10	17	$3\frac{3}{4}$
£.	69	12	$8\frac{1}{4}$

Weight of the grain, per Winchester bushel, weighed at the time of sale, sixty-one pounds and a half.

Expenses of Drilling four Acres of Wheat.

	£.	s.	d.
Seed, six bushels one peck, at 8s. per bushel -	2	10	0
Ploughing the four acres once, at 5s. per acre	1	0	0
Rolling the land before the drill machine to close and level the same, boy and horse half a day	0	1	$7\frac{1}{2}$
Two men and a horse half a day, together with a boy to lead the horse drilling the wheat -	0	3	$7\frac{1}{2}$
Carried forward, £.	3	15	3

Harrowing

	£.	s.	d.
Brought forward,	3	15	3
Harrowing the seed to cover it with earth, two horses and a boy half a day - -	0	2	10½
March 12, one man half a day 1s. a horse half a day 1s. 3d. together with a lad to lead 4½d. hoeing first time - - -	0	2	7½
April 4th, repeated the hoeing - -	0	2	7½
May 12th, one woman a day drawing such weeds as escaped the horse-hoe, by being intermixed in the rows of wheat - - -	0	0	8
Reaping the four acres, at 8s. 6d. per acre -	1	14	0
Threshing and carrying to market sixteen quarters three bushels of wheat - -	2	9	1½
Expenses of cultivating four acres of drilled wheat £.	8	7	2

Produce of four Acres of Drilled Wheat.

	£.	s.	d.
Sixteen quarters three bushels, sold to the merchant at 64s. per quarter - -	52	8	0
Value of the straw grown upon the four acres, estimated as in the two foregoing experiments, one ton nineteen hundred weight two stone four pounds per acre, or, on the whole four acres, seven tons seventeen hundred weight one stone two pounds, at 3s. per hundred weight	23	11	5
Value of the produce of the four acres of drilled wheat - - - £.	75	19	5
Expenses of cultivating the four acres of drilled wheat, to deduct - - -	8	7	2
£.	67	12	3

Weight of the grain per Winchester bushel, weighed at the time of sale, sixty pounds.

Before

Before I proceed to my statement of the fallow experiment, I shall take a comparative view of the above results in as concise a manner as possible, by briefly stating the expenses of cultivating an acre of land under each respective mode; applying thereto the local expenses of the parish or neighbourhood where the experiment was conducted.

Expenses of Cultivating an Acre of Wheat after the Broadcast Method of Husbandry.

	£.	s.	d.
Rent of land per acre	1	10	0
Composition for tythes	0	7	0
Parochial rates	0	9	6
Ploughing once for the crop	0	6	0
Seed	0	16	0
Sowing	0	0	3
Harrowing in the seed	0	1	5¼
Rolling and completing the work	0	0	8½
Weeding	0	8	8
Threshing and carrying to market	0	10	8¼
Interest upon capital employed, say 10l. per acre, the lowest rate at which a farmer can now stock his land at per acre	0	10	0
	£. 5	8	9

Expenses of Cultivating an Acre of Dibbled Wheat.

	£.	s.	d.
Rent of an acre of land	1	10	0
Composition for tythes	0	7	0
Carried forward, £.	1	17	0

Parochial

	£.	s.	d.
Brought forward,	1	17	0
Parochial rates	0	9	6
Ploughing once for the crop	0	6	0
Seed	0	12	0
Dibbling	0	10	0
Harrowing in the seed after the dibbler	0	0	5
Weeding	0	4	9½
Reaping	0	8	6
Threshing and carrying out the crop	0	12	10½
Interest upon capital employed	0	10	0
	£. 5	11	1

Expenses of Cultivating an Acre of Drilled Wheat.

	£.	s.	d.
Rent	1	10	0
Composition for tythes	0	7	0
Parochial rates	0	9	6
Ploughing for the crop	0	6	0
Seed	0	12	6
Drilling	0	0	10½
Harrowing in the seed	0	0	10¾
Rolling the ground before drilling	0	0	4¾
Weeding	0	1	3¾
Reaping	0	8	6
Threshing and carrying to market	0	12	3½
Interest upon capital employed	0	10	0
	£. 4	19	3

	£.	s.	d.
Produce of an acre of broadcast	11	8	3
Expenses of cultivating an acre of do.	5	8	9
Profit	£. 5	19	6

	£.	s.	d.
Produce of an acre of dibbled wheat -	13	15	0
Expenses of cultivating an acre of dibbled wheat	5	11	1
Profit - - -	£.8	3	11

	£.	s.	d.
Produce of an acre of drilled wheat -	13	2	0
Expenses of cultivating an acre of do. -	4	19	3
Profit - - - -	£.8	2	9

This statement is upon the supposition that the straw is of no other value to the grower than to convert into manure upon the premises, which is really the case with farmers in general, who are restricted from selling their straw by a covenant in their lease. Under circumstances where the straw is of a real marketable value, the disadvantages of the broadcast mode of husbandry will appear somewhat less; as a little must be allowed for its superiority in weight of straw over the drilled.

Experiment on the Comparative Culture of Wheat, upon a Preparation called a Bastard Fallow, by Mr. ROBERT BURROWS, *of Great Witchingham, in the County of Norfolk.*

Before I enter upon a description of the method pursued in the present instance, together with the result of the produce obtained, I shall first endeavour to explain what is meant by the husbandry term bastard fallow. From what I have seen of the agriculture of other counties, it appears to me to be a practice peculiar to the county of Norfolk; and

even

even there I am glad to acknowledge, that together with the real fallowists of other counties, its advocates are daily growing fewer. Surely it must be absolute barbarism in husbandry, to plough up a field of clover or grass layer, in the midst of the hot dog-days of summer, and to embrace, as it were, with eagerness every opportunity of exposing its surface to the exhausting influence of a scorching summer's sun; yet such, if we may judge from the practice, seems to be the wish of every description of fallowists. The kind of fallow under consideration is ploughed up immediately upon the first rain sufficiently heavy to enable the plough to work after Midsummer; then again before harvest, and two or three times more before sowing the wheat. Such repeated ploughings, besides the injury they do in exhausting the soil, must undoubtedly be charged as labour to the account of the ensuing crop; nor is the farmer aware, that by forcing into existence every particle of vegetable matter the soil is capable of affording, though by that means he may obtain a considerable deal of straw to the crop immediately in view, yet he is by such practices reducing his land to a state of poverty and exhaustion incapable of affording sufficient nourishment for ensuing crops. Injudicious and repeated summer ploughing, I have not a doubt, impoverishes land, and renders it more barren than heavy and abundant crops of either hay or corn; and I trust that the increasing influence of public societies, established with a view of disseminating useful practical opinions, together with the example of liberal and enlightened farmers, will soon have the desirable effect of banishing from the husbandry of these kingdoms, those ridiculous and absurd prejudices that have so long disgraced that first of all professions, and grand source of all wealth—Agriculture.

In conformity to the practice above alluded to, upon the 24th, 25th, and 26th of July 1806, I ploughed up twelve acres of a clover stubble, in a field adjoining to the one where the first experiment was made, and of a similar soil, that is to say, a tolerably good sandy loam. This ploughing was only just fleetly skimming the surface with the Norfolk wheel plough, about two inches deep, cross ploughed the twelve acres again about the 1st, 2nd, and 3rd days of September, harrowing the same well three times in a place. In this state the field lay until after harvest; then, about the beginning of October ploughed the same again; harrowing the land after the plough as before: I should here observe, the two last-mentioned ploughings were about 4½ inches in depth. On the 28th, 29th, and 30th of October, I had the whole twelve acres divided by the chain in divisions of four acres each laying, two of those divisions into stitches of twelve small furrows, each furrow nine inches wide, making the stitches three yards each across. These two divisions were now fit for the operation of dibbling and drilling, which immediately commenced; the first by dibbling two rows of holes upon each furrow, equidistant from each other four inches and a half, bush-harrowing directly after to fill up the holes with earth: whilst this was performing, a man, a boy, and a horse, put in the four acres adjoining, with Cooke's drill-machine, in rows nine inches asunder; each stitch formed exactly one bout for the machine, the horse up in one furrow and back in the other, which was effected by only moving the shafts of the machine nearer to the end of the beam, holes for that purpose being made in all Cooke's machines; thus upon each stitch were twelve rows, or one row upon a furrow, equal, as I have before observed, to the two rows of dibbled; and in this

this instance exactly an equal quantity of seed used as in the dibbled work, an account of which will appear in the statements that follow. These two operations were performed upon the 31st of October, and 1st of November, at the same time the wheat was sown on the division appointed for the broadcast experiment, and had the same neatly ploughed under, in depth about three inches, laying the stitches into the same size as in the two foregoing experiments. The seed made use of was likewise of the old Kentish red stock, and had been sown upon the farm without changing, for many years past; nor was any manure made use of, for reasons mentioned in the first part of this paper.

The appearance of the crop throughout the summer was much the same as noticed in the former experiment: the drilled crop, from its first coming up till the whole field was in ear, always looked the richest and most pleasing to the eye. The expenses of weeding, &c. were nearly the same as in the clover stubble field, as will appear hereafter, and as to the deficiency in point of produce, I can attribute it to no other cause than the pernicious one above complained of, viz. the barbarous system of fallowing. The result of this latter experiment confirms me more than ever of the justness of my first notion, in not making use of manure in my experiment; as the land in this fallow experiment was in itself richer, and I believe, in regard to its state of condition, had rather the advantage of the clover stubble field. I believe in districts where this kind of husbandry is most prevalent, an ample manuring is in general made use of; yet after the additional expense of manure, an observer may easily perceive the crop is not more productive, nor even so much so, as a simple clover lay without any manuring whatever. Hence it is evident the fallowist fallows away as

much, or more vegetable matter, than an ample manuring will again restore to the soil.

Expenses of four Acres of Broadcast Wheat.

	£	s.	d.
Ploughing the land three times, at 5s. per acre each time	3	0	0
Seed, eight bushels	3	4	0
One man ½ a day sowing the same	0	1	0
Ploughing the seed under, four acres, at 5s. per acre	1	0	0
Weeding, as in the former instance, done principally by hand, or the small hand-hoe: put out the work to two women, at 4s. per acre the first time, and 2s. per acre the second time of hoeing, together with three days work each at 8d. per day each, drawing by hand the remaining weeds that escaped the twice hoeing	1	8	0
Reaping the four acres, at 8s. 6d. per acre	1	14	0
Threshing and carrying to market, twelve quarters four bushels and half a peck of wheat	1	17	6½
Expenses of cultivating 4 acres of broadcast wheat	£12	4	6½

Produce of four Acres of Broadcast Wheat.

	£.	s.	d.
Twelve quarters, four bushels, and half a peck, sold to the merchant at 64s. per quarter	40	1	0
Value of the straw grown upon the above four acres, estimated as in the clover stubble experiment, at 3s. per hundred weight, seven ton five hundred weight five stone two pounds	21	16	11
Value of the four acres of broadcast	£61	17	11
Expenses of cultivating the four acres of broadcast wheat	12	4	6½
Profit	£49	13	4½

Weight of the grain per Winchester bushel at the time of sale, fifty-nine pounds and a half.

Expenses

Expenses of Dibbling four Acres of Wheat.

	£.	s.	d.
Ploughing the land four times for the crop -	4	0	0
Seed, seven bushels, at 8s. per bushel -	2	16	0
Dibbling four acres, at 10s. per acre -	2	0	0
Rolling the land before dibbling, a lad and two horses half a day - - -	0	2	10½
Bush harrowing to bury the seed, a lad and one horse half a day - - -	0	1	7½
Weeding, at 4s. per acre the first time, and 2s. the second time, two women four days drawing weeds by hand - - -	1	9	4
Reaping the four acres, at 8s. 6d. per acre -	1	14	0
Threshing and carrying to market fourteen quarters one bushel one peck, at 3s. per quarter -	2	2	5½
Expenses of cultivating four acres of dibbled wheat - - -	£14	6	3½

Produce of the four Acres of Dibbled Wheat.

	£.	s.	d.
Fourteen quarters one bushel one peck, sold to the merchant, at 64s. per quarter - -	45	6	0
Value of the straw of the four acres of dibbled wheat, at 3s. per cwt. seven tons fourteen cwt, two stone four pounds - - - -	23	2	10
Value of the produce of the four acres of dibbled wheat - - - -	68	8	10
Expenses of cultivating the four acres of dibbled wheat - - - -	14	6	3½
Profit -	£54	2	6½

Weight of the grain per Winchester bushel at the time of sale, fifty-nine pounds and a half.

Expenses of Drilling four Acres of Wheat.

	£.	s.	d.
Ploughing four acres four times, at 5s. per acre each time	4	0	0
Seed for the four acres, at seven pecks per acre, seven bushels, at 8s. per bushel	2	16	0
Rolling the land for the drill, half a day, lad and one horse	0	1	7½
One man, a lad, and a horse, half a day drilling the four acres; the man at 2s. the horse at 2s. 6d. and the lad at 9d. per day each	0	2	7½
Harrowing after the seeds to close the drills, two horses and lad, say half a day	0	2	10½
One man half a day, with a horse and a lad hoeing the first time	0	2	7½
Second hoeing, though not absolutely necessary, as before	0	2	7½
Drawing weeds by hand, one woman a day	0	0	8
Reaping the four acres, at 8s. 6d. per acre	1	14	0
Threshing out and carrying to market thirteen quarters seven bushels and three pecks of wheat, at 3s. per quarter	2	1	11
Expenses of cultivating the four acres of drilled wheat	£11	4	11½

Produce of four Acres of Drilled Wheat.

	£.	s.	d.
Thirteen quarters seven bushels three pecks of wheat sold to the merchant, at 64s. per quarter	44	14	0
Value of the straw, at 3s. per cwt. seven tons eleven cwt. three stone six pounds	22	14	3
Value of the produce of four acres of drilled wheat	£67	8	3
Expenses of cultivating the four acres of drilled wheat	11	4	11½
Profit	£56	3	3½

Weight of the grain per Winchester bushel at the time of sale, fifty-eight pounds three quarters.

Again,

Again, as in the first experiment, I shall state the expenses and produce of a single acre under each mode of husbandry, and apply it, as in the former case, to the parcular spot where the experiment was conducted.

Expenses of cultivating an Acre of Broadcast Wheat, under a Fallow System of Husbandry, without Manure.

	£	s.	d.
Rent of an acre of land	1	10	0
Composition for tythes	0	7	0
Parochial rates	0	9	6
Ploughing for the crop, four times	1	0	0
Seed	0	16	0
Sowing	0	0	3
Weeding	0	7	0
Reaping	0	8	6
Threshing and carrying to market	0	9	4½
Interest upon the capital employed, say, as in the former estimate, £10 per acre	0	10	0
Expenses of cultivating an acre of broadcast wheat	£3	17	7½

Expenses of cultivating an Acre of Dibbled Wheat.

	£.	s.	d.
Rent of land	1	10	0
Composition for tythes	0	7	0
Parochial rates	0	9	6
Ploughing for the crop, four times	1	0	0
Seed, seven pecks	0	14	0
Dibbling	0	10	0
Bush-harrowing after dibbling, together with rolling the land for the dibbles	0	1	1½
Carried forward,	£4	11	7½

Weeding

	£.	s.	d.
Brought over,	4	11	$7\frac{1}{2}$
Weeding - - -	0	7	4
Reaping - - -	0	8	6
Threshing and carrying to market -	0	10	$7\frac{1}{4}$
Interest upon capital - -	0	10	0
Expenses of cultivating an acre of dibbled wheat	£6	8	$0\frac{3}{4}$

Expenses of cultivating an Acre of Drilled Wheat.

Rent of land - - -	1	10	0
Composition for tythes - -	0	7	0
Parochial rates - - -	0	9	6
Ploughing for the crop, four times -	1	0	0
Seed, seven pecks - -	0	14	0
Drilling - - - -	0	0	$7\frac{3}{4}$
Harrowing in the seed and rolling before the drill	0	1	$1\frac{1}{2}$
Weeding - - - -	0	1	$5\frac{3}{4}$
Reaping - - - -	0	8	6
Threshing out the crop and carrying to market	0	10	$5\frac{3}{4}$
Interest upon capital - - -	0	10	0
Expenses of cultivating an acre of drilled wheat	£5	12	$8\frac{3}{4}$

	£.	s.	d.
Produce of an acre of broadcast wheat	10	0	3
Expense of an acre of ditto -	5	17	$7\frac{1}{2}$
	£4	2	$7\frac{1}{2}$
Produce of an acre of dibbled wheat	11	6	6
Expense of an acre of ditto -	6	8	$0\frac{3}{4}$
	£4	18	$5\frac{1}{4}$
Produce of an acre of drilled wheat	11	1	0
Expenses of an acre of ditto -	5	12	8
	£5	8	4

Having

Having now brought each set of experiments to a conclusion, I shall here observe, that I have been as correct (even to the expense of a single farthing) as so large an experiment would admit of; and that however tedious and troublesome it has been to me, by often interfering with other departments of my business, yet such has been my ardent wish to see fairly decided so important a question in agriculture, as the best method of depositing the seed of any grain whatever, that I have never suffered any operation in the conducting the present business to be performed without my own personal inspection; and, in estimating the expenses, I have been cautious in fixing them within the moderate bounds of near and economical husbandry. In the account of my fallow experiment, I have charged nothing for the harrowings which took place subsequent to the two middle ploughings; my reasons for not doing it were on account of finding by experience in the conducting of the work itself, that in those long days a man, two horses, and plough, would do nearly one acre and three quarters per day, which at 2s. 6d. per day each horse, and 2s. the man is 7s. per day; an acre and three quarters at 5s. per acre, is 8s. 9d. per day. The overplus, 1s. 3d., I let go to the expense of harrowing; nor have I charged any thing for harvesting the wheat, against which I set the chaff, &c. from the barn doors at the time of threshing, the value of which I think will just about cover the expense of carting home in harvest. In the following manner I obtained the criterion by which I estimated the weight of straw grown upon an acre of each. In the beginning of harvest, one man went with me into each field, and in an exact and careful manner we set apart one square perch in each division, chosen from an average part

of

of the field; I had the same reaped and tied up in sheaves, and which stood to weather in the field the necessary time. Then I had them all conveyed to the barn, there separately threshed, and the grain from each perch measured, together with the straw nicely weighed; the result thereof is annexed.

Clover Stubble Experiment.

Measure of grain in a square perch of the broadcast wheat.	Weight of straw in a square perch of the broadcast wheat.
11¼ pints.	2 stone ¾ lb.
Winchester measure.	14 lbs. to the stone.

Clover Stubble Experiment.

Measure of grain in a square perch of the dibbled wheat.	Weight of straw in a square perch of the dibbled wheat.
13½ pints.	2 stone 1¾ lbs.
Winchester measure.	14 lbs. to the stone.

Clover Stubble Experiment.

Measure of grain in a square perch of the drilled wheat.	Weight of straw in a square perch of the drilled wheat.
13 pints.	1 stone 13½ lbs.
Winchester measure.	14 lbs. to the stone.

Fallow Experiment.

Measure of grain in a square perch of the broadcast wheat.	Weight of straw in a square perch of the broadcast wheat.
10 pints.	1 stone 11½ lbs.
Winchester measure.	14 lbs. to the stone.

Fallow Experiment.

Measure of grain in a square perch of the dibbled wheat.	Weight of straw in a square perch of the dibbled wheat.
11½ pints.	1 stone 13 lbs.
Winchester measure.	14 lbs. to the stone.

Fallow Experiment.

Measure of grain in a square perch of the drilled wheat.	Weight of straw in a square perch of the drilled wheat.
11¼ pints.	1 stone 12½ lbs.
Winchester measure.	14 lbs. to the stone.

CER-

CERTIFICATE.

WE whose names are here undersigned, do certify, that the foregoing set of experiments upon the comparative culture of wheat have been conducted in an able and masterly manner, and fully calculated to attain the object in view, namely, the ascertaining of the best mode of depositing the seed in the ground; and we do likewise further certify, that the nature and condition of the soil is as within described, namely, a fine sandy loam, in a high state of cultivation. We have also viewed the crop during the time of growing, and do pronounce it to have been kept perfectly free and clear from weeds of every description, in the manner and at the expense within stated by the cultivator, Mr. ROBERT BURROWS, of Great Witchingham, in the county of Norfolk.

PETER LE NEVE FOSTER, Great Witchingham.
JOHN ELMER, Great Witchingham.
WILLIAM FITZ MAY, Great Witchingham.
JOHN BOND, Cawston.
JAMES NORTON, Cawston.

The SILVER MEDAL *of the Society was this Session voted to* J. BUTLER, *Esq. of Bramshott, Hants, for his Improvement of Waste Land, and the following Communication was received from him.*

SIR,

IN the year 1802 I purchased an estate, situated in the parish of Bramshott, in the county of Hants, of which seventy acres and upwards were then waste lands, growing a little

a little timber, furze, and alder, and supporting a few cows in the summer, but never cultivated or considered worth that expense.

From particular engagements at the time, I did not begin any improvement till 1804, when I found sixty-five acres and a half (statute) of the said waste lands in the following state: twelve acres, the scite of old fish ponds, growing nothing but reeds and rubbish; eighteen acres one rood thirty-seven perches, affording a little sour grass and a few alders in wet places; twenty-seven acres three roods one perch, quite a morass or bog, with a few alders; and seven acres one rood four perches of very indifferent furze.

As the greatest part of the waste was filled with innumerable springs that deluged the whole, and caused the bog to be saturated throughout the year, I considered that draining was the first necessary step to be taken; with this view I made an open cut or ditch, of five to seven feet deep or more, in the lowest part of the bog, to let out the stagnated water, and ascertain with precision the cause that produced it. Having obtained the lowest possible fall by the open cut or ditch, I caused other cuts to be made to the heads of different springs which fed the land, occasionally boring with the auger, that no spring might be passed over; and I then laid the open cuts or drains with stones from three to twelve feet below the surface, according to circumstances, to carry off the water, observing always to keep the level.

At the highest ground I found rocks under which the principal springs lay, at the distance of at least fifteen feet, and from thence an immensity of water gushed out, which was easily passed off through the drains, and I had the satisfaction

satisfaction to find, that in the course of two years the whole waste became perfectly dry, and so continued.

The extent of land thus drained being great, the cost of course is very considerable, and amounts to the sum of 338l. 2s. 11d.

During this I grubbed the greatest part of the land, which from the stems of oak and other timber that had formerly grown there, as well as the alder, furze, and some timber standing at the time I made the purchase, was no inconsiderable work, and cost for each oak stem ninepence, and for the soil on which the alders and furze grew, sixpence per rod, amounting in the whole to the sum of 95l.

The ground being now cleared, I ascertained, by the means of a water level, the position of a little brook which ran through the waste land, and found that it was practicable to turn water over thirty acres of it. This being an object of the first consequence, I spared neither pains nor expense to accomplish it; I removed the high banks round the fish ponds, which contained some thousand loads of soil, filled up very deep ditches and stew ponds, and laid several acres on an inclined plane; burnt the roots and rubbish, and prepared, by levelling and making water carriages, thirty acres for irrigation, of which sixteen acres, though rough and some pasture as before described, had by draining and feeding began to improve considerably; and in the spring of 1806, I was enabled to turn the water over such sixteen acres, from which I derived a tolerable crop of hay in that summer; feeding it harder afterwards, and watering it the following winter, there was a good supply of feed for sheep till the latter end of April, when it was laid up and watered as before, but with far better success, as the crop was not only

only greatly improved in quality, but likewise in quantity, producing more than two tons to an acre throughout the sixteen acres.

The residue of the thirty acres prepared for irrigation as before stated, formerly fish ponds and other rough lands, but lately levelled and sown with perpetual grasses, is now looking remarkably well, and will certainly be in readiness to receive the water, as soon as the land is firm enough for that purpose.

In accomplishing this work I had the assistance of Joseph Trigger, who lived with and managed the water meadows of the late Mr. Bakewell of Dishley, for more than twenty years; and it would be an act of injustice to him not to say, that the said land is prepared for a water meadow in a masterly style; this cost me not less than 223l.

As soon as I perceived the effect of my drains on the bog, which was composed of a good deep peat, I pared by hand thirteen acres of it, which I burnt, and spread the ashes; then ploughed the land once, and sowed it with cole seed in the month of July. The crop turned out very good, and fed one hundred and sixty-two shear hogs (Leicester) for two months; after which I ploughed it once only, and sowed it with white oats in the month of April 1807: at first the oats appeared sickly, but receiving a few warm showers in May, they recovered and flourished exceedingly, making a most excellent appearance, to the astonishment of the neighbourhood; for when reaped, they were estimated at from ten to thirteen quarters per acre, some parts being preferable to others, but the whole good; and I have no doubt, for at present they are not threshed, that the crop will amount to its estimate.

In the course of last year I pared seven acres more of the said

said bog, and burnt and spread the ashes in a similar way to the former, and sowed it with cole seed from one ploughing in July last, which likewise turned out a most excellent crop, and supported seventy-two large sheep on it for more than two months.

The expense of paring and burning the twenty acres came to 29l. 10s.

The remaining waste land being a lighter peat, mixed more with sand, I did not think it adviseable to pare and burn, but contented myself with fallowing it for turnips, with which it was sown last summer; but from the indifference of the season, the crop did not prove abundant, yet as much so as I had any reason to expect; and I have no doubt, by proper management of it, though by far the worst of the waste, it will shortly become very useful land, and produce in succession good turnips, barley, and seeds.

On a review of the foregoing statement, it will appear that the expense attending the improvement of the waste has been great; but it will be recollected, that the quantity of land reclaimed is very considerable, the greatest part of which has been drained and grubbed, and the face of it entirely changed; that on the comparison I now submit, I feel great satisfaction in being enabled to assert, in the judgment of able men, that at the time I made the purchase, the waste land was not worth more than 5s. per acre per annum on an average, which amounts to 16l. 7s. 6d. and that it is now worth and let as follows:

	£.	s.	d.
Sixteen acres of water meadow, 3l. per acre	48	0	0
Fourteen do. will shortly be as valuable -	42	0	0
Carried forward, £.	90	0	0

Brought forward,	£. 90	0	0
Twenty do. of reclaimed bog, 2l. per acre -	40	0	0
Fifteen and a half do. lighter peat, 1l. per acre	15	10	0
By the year - - -	£. 145	10	0

I have not pointed out minutely every step that has been taken to drain, to irrigate, or improve the said waste lands, because the subject is generally so well understood; but I trust I have stated sufficient to prove, that the soil, thus reclaimed, is turned to a great and lasting benefit.

J. BUTLER.

Bramshott, Hants,
Jan. 28, 1808.

To C. Taylor, M. D. Sec.

Certificates were received from the following persons, in testimony of the accuracy of Mr. Butler's statement.

Samuel Mence, Curate of Bramshott.
George Curtis, Surgeon.
Francis Denyer, Overseer.
James Chase, Churchwarden.
William Money, Yeoman.
John Fullech, Yeoman.
John Rowland, Tenant of the Premises.

The

The SILVER MEDAL *of the Society was this Session voted to* MR. SAMUEL CURTIS, *of Walworth, for planting an extensive Orchard at Bradwell in Essex. The following Communications were received from him.*

SIR,

I TAKE the liberty of sending you an account of an undertaking, for which I hope I shall be entitled to some notice from the Society of Arts, &c. I do not know whether they have offered premiums or medals for planting fruit trees, nor do I suppose it is always requisite, as I understand the Society confer their favors without such offers for matters they think deserving of them.

Two years ago I took a small farm in Essex, (a county where fruit is scarce,) consisting of near fifty acres. As the soil appeared proper, and the aspect favorable, I converted the whole into an orchard, by planting one hundred trees on each acre, in the following manner, viz. The fruit trees are placed in rows one rod asunder; between each row is a space of two rods; the plants are cherries, and apples or pears alternately, so that one half of the plantation consists of cherry trees. In about twenty or thirty years the apple and pear trees will require the whole of the ground; the cherry trees are then to be cut out, leaving the apple and pear trees uniformly two rods asunder each way, and in straight lines.

The orchard is now completed with the best kinds known or produced in the nurseries, in the whole nearly five thousand standard trees. They are well staked, and have

been properly pruned twice a year. Farming crops have been since produced on the same ground as good as formerly, the plough being allowed to go within two feet of the trees each way, so that for many years to come the land will pay the expenses, and yield a profit exclusive of the fruit. I have in one part planted medlars, quinces, plums, walnuts, and other trees, to make the fruit collection as complete as possible, and I have spared no expense which could tend to improve the whole.

I shall make it an object to destroy the coccus, an insect which is at present damaging all our orchards. I know the application of spirits of turpentine will do it, without injuring the trees; it is by far the most easy and expeditious method for that purpose.

I am, Sir,

Your obedient servant,

SAMUEL CURTIS.

Walworth, Dec. 12, 1807.

To Charles Taylor, M. D. Sec.

Certificates from M. P. Carter, D. D. Rector of Bradwell, and Mr. Thomas Fairhead, Churchwarden, confirmed that Mr. S. Curtis had planted about four thousand standard fruit trees on about forty-eight acres of land, and that the same were, on the 7th of April, 1808, in a thriving condition.

SIR,

SIR,

THE certificate I sent you relative to my orchard, stated the number of trees to be about four thousand, but the real number is 4620 trees. I am sorry to have occasion to notice to you a disease in pear trees, almost as destructive, although not so frequent as that I mentioned to be produced from the insect on apple trees. This upon pear trees appears as a dry rotten scab, which keeps increasing until it penetrates even the hard wood, and as it proceeds surrounds the limb entirely. The following spring the limb dies from the diseased part upwards. I have not found any insect to be concerned in this disease, which frequently takes place upon the trees of most luxurious growth. Its commencement seems to be from the thick rind of the tree becoming spongy; it then begins to crack and look scabby, the inner bark becomes dark coloured, and the disease proceeds until the destruction of the limb takes place. Some particular sorts of pear trees are with me much more liable to this disease than others: Windsor, autumn, bergamots, Catharine pears, &c. I suspect the disease to arise in a great measure from the soil.

My new orchard is situated at Glazen Wood, near Coggeshall, in Essex. I think myself highly honoured by the inquiries of her Serene Highness the Margravine of Anspach concerning it. As her Highness has attended to the pruning of fruit trees both in England and on the Continent, doubtless she is aware of the existing diseases in apple and pear trees,—any easy remedy for them would be of immense consequence; and if her Highness can furnish any discovery relative thereto, it would confer a great service on the p

lic, and be esteemed by me a very particular obligation and honor.

I remain, Sir,

Your obedient Servant,

SAMUEL CURTIS.

Glazen Wood, near Coggeshall,
June 3, 1808.

To C Taylor, M. D. Sec.

The Silver Medal *of the Society was this Session voted to Mr.* Richard Parkinson, *of Walworth, near London, for his Method of curing the Foot Rot in Sheep. The following Communications were received from him.*

SIR,

The inclosed is the recipe for the cure of the foot rot in sheep, certified by the person who was my shepherd at the time I put the method into practice.

I am, Sir,

Your very obedient Servant,

R. PARKINSON.

18, *Harford Place, Walworth,*
April 6, 1807.

To C. Taylor, M. D. Sec.

To Cure the Foot Rot in Sheep in the best and most effectual Manner.

In sheep thus affected, pare their hoofs, leaving no hollow to hold dirt; if there be matter formed, be particularly careful to let it out; after which, take some stale urine and wash their feet clean from dirt, and wipe them with a sponge; then put the sheep into a house or shed, the floor of which has been previously spread about two inches thick with quick lime, reduced to powder by a small quantity of water. The fresher the lime is from the kiln the better. Let the sheep stand upon it for six or seven hours, and the cure will be effected.

A Certificate, dated March 27, 1807, from Joseph Dunnington, stated his being shepherd to Mr. Parkinson, at Slane in Ireland, in the year 1803, and that he then witnessed the efficacy of the above remedy on a large flock of sheep.

Further Certificates from the Earl of Conyngham, from Mr. Stephen Parkinson, and from Joseph Preston, shepherd to Mr. John Parkinson of Bolingbroke, confirmed the above statement.

The SILVER MEDAL *of the Society was this Session voted to* Mr. W. WALLIS MASON, *of Goodrest Lodge, near Warwick, for his Method of Stabbing Hoven Cattle, to discharge the Rarified Air from the Stomach, when they have been overfed with moist Clover Grass. The following Communications were received from him.*

GENTLEMEN,

I BEG leave to lay before you a trocar and canula, for the relief of cattle, when gorged or hoven. Since I have introduced it, it has been used with the greatest success, having, in every instance tried, been proved a safe, easy, and effectual remedy.

I consider it will not be necessary for me to detail the dangerous consequences arising from cattle being hoven, as it is well known that the public are annually deprived of numbers of valuable cattle by this disorder. I am inclined to offer it as an instrument superior to that, for which the Society granted a premium in the year 1796, as I am of opinion that flexible tubes may be forced down the ventricle which conducts to the lungs, by which most dangerous consequences would ensue. An instance of this kind occurred last year in this neighbourhood, when intending to force the passage of the paunch, and occasioned the loss of the animal.

Neither the farmer or bailiff can be expected, when going the rounds of the farm, to carry with him at all times an instrument so large as one of the flexible tubes; even if he had it, he could not make use of it without the assistance of

of a second person, and the disorder would be fatal in most instances, before such assistance could be procured.

I considered that the trocar and canula, commonly used by surgeons, might be employed to advantage for the relief of hoven cattle. I have improved the instrument, to answer better the purpose here intended of penetrating the tense hides of cattle, and such alteration materially facilitates the operation.

The method of applying it is, to penetrate with the trocar and canula through the hide of the beast, to the paunch on the near side, about six inches from the back-bone, at an equal distance from the last rib, and from the hip-bone; then to withdraw the trocar, and to leave the canula in the wound, until the air which the paunch contained has escaped. The canula may then be taken out, and the wound covered with a plaster of common pitch, spread on brown paper, about the size of a crown piece. All the danger incidental to the common mode of stabbing with the knife is effectually prevented, by the canula being left in the incision when the trocar is withdrawn.

The small expense of the instrument, its portability, the ease with which it can be used by an individual, its safety and efficacy in use, as it has not in any instance failed of complete success, will, I hope, be sufficiently evident to recommend it to the attention of the Society. A great saving would arise to the owners of cattle, and to the country at large, from general adoption of its use.

A feeding ox will thrive as well after the operation as if it had never been affected by the disorder. Cows in calf are in no danger from its use. It has been found particularly beneficial in preserving rearing calves, and young cattle, when afflicted with this disorder, which had heretofore been fatal to great numbers of them.

I beg

I beg leave to add the certificates of a few of those gentlemen who have witnessed the utility of this method, and whose recommendations have stimulated me to submit it to the Society, in hopes, that by their liberal patronage, it may be rendered more generally beneficial to the public.

I have the honour to remain, Gentlemen,

Your obedient Servant,

W. WALLIS MASON.

Goodrest Lodge, near Warwick,
February 24th, 1808.

Certificates from the following gentlemen, testified that they had experienced the validity of Mr. Mason's trocar, had proved the safety of the operation, and the instantaneous relief which it had never failed to produce without leaving any blemish, or dangerous consequence, from its application.

JOHN FOORD NAISH, Leek Wootton.
THOMAS BRYAN, Warwick.
WILLIAM ORAM, Warwick.
WILLIAM LEDROOKE, Northend.
RICHARD CATTELL, Milverton.

To the Society of Arts, &c.

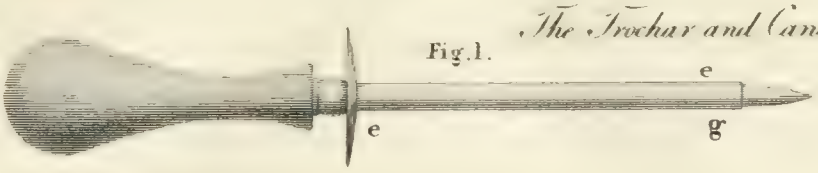
Reference to the Engraving of Mr. WALLIS MASON'S *Trocar and Canula.*

Fig. 1, Pl. 1, is a representation of Mr. Wallis Mason's trocar and canula. The blade of the trocar is of steel *aa*, fig. 4, fixed into a wooden handle *bb*. The shape of the blade of the trochar is oval, as shown in the end view of the canula, fig. 3. The canula or sheath *ee*, figs. 1 and 2,

Mr. Mason's Trochar for relieving Hoven Cattle.

The Trochar and Canula.

Fig.1.

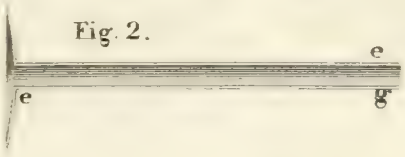


End view of the Canula.

Fig.3.

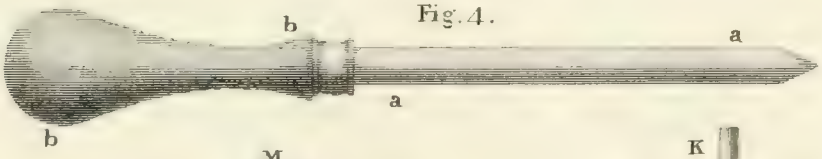
Section of the Canula.

Fig. 2.



Trochar by itself.

Fig.4.



Mr. I. Fisher's improved Churn Staff.

Fig.5.

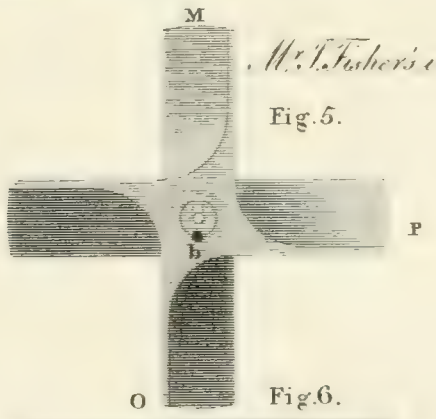
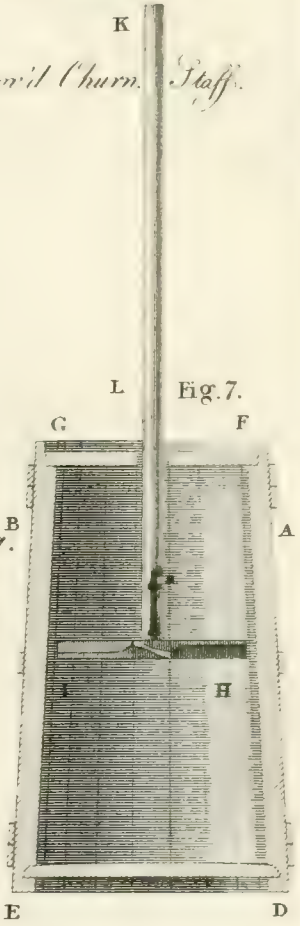


Fig.6.

K

L

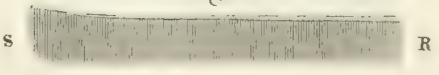
Fig.7.



Mr. Tansley's method of cutting Thaj.

Fig.8.

Fig.9



2, is an oval tube, which exactly fits the blade of the trocar; *ff* is a concave circular plate, fixed at the end of the canula, forming a hilt, to prevent the instrument from giving too deep a wound when used; the end *g* of the canula is worked down to a sharp edge, that it may not obstruct the passage of the instrument. The drawings are on a scale of one inch to two inches and a half; in figs. 1 and 2, the trocar and canula are shown edgeways, or in the shortest diameter of the ellipsis; in fig. 4, the trocar is shown flat, in its longest diameter.

FIVE GUINEAS *were this Session voted to Mr.* TIMOTHY FISHER, *of Ormskirk, Lancashire, for a Swivel-headed Churn Staff, to facilitate the making of Butter. The following Communications were received from him.*

SIR,

I BEG leave to lay before the Society of Arts, &c. my swivel-headed churn staff, which, on repeated trials, is now fully proved to answer the very desirable purpose of relieving the hard labour of churning, which it does in a much greater degree than could be supposed, from a slight view of its simplicity and apparent small deviation from the common churn staff. It however passes with much more ease through the cream. It must be worked much slower than the common, otherwise it is found to churn the cream too soon, or, according to the technical term in this county, *to swelt it.*

I have

I have tried it in a variety of forms and sizes: with six wings the labour was less relieved; also when I gave less bevel to the ends of the wings.

When I gave more bevel it passed through without producing the intended effects. Experience therefore has convinced me, that it is best to have four wings from six to seven inches in length, from the centre, according to the size of the churn for which it is intended, from two and a half to three inches in breadth, made plane in the centre or middle, about the fourth part of their length, and then bevelled regularly off, so that the extreme point shall form an angle of about 45 degrees with the plane of the middle. The plane part acts with its usual force upon the middle of the body of the milk; and the points turning rapidly round, give a kind of compound motion to the whole, and that also alternate, and yet it does not in the least splash or throw out the cream as in the common mode.

The small bolt at the side, which I make of wood, is to lock the head, and prevent the wings from turning round whilst the butter is collected from the milk when the operation of churning is completed.

I am, Sir,

Your obedient Servant,

TIMOTHY FISHER,
Gun-maker.

Ormskirk, Lancashire, May 1st, 1808.

To C. Taylor, M. D. Sec.

Thomas

THOMAS ECCLESTON, Esq. of Scarisbrick Hall, near Ormskirk, certified, that he had seen Mr. Fisher's new method of churning butter, and that he thinks it superior to any he had heretofore known for that purpose, and that such was also the opinion of several other persons in the farming line who had witnessed its effects.

Reference to the Engraving of Mr. FISHER's *Churn Staff.*

Fig. 7, Pl. 1, is a section of an upright churn, in the situation it would be when at work, and figs. 5 and 6 are enlarged views of the head of the churn staff. ABDE fig. 7, is a section of the churn; FG is the lid; KL is the churn staff, and HI the wings, or beaters; it is this part only which differs from the ordinary churn; it consists of four wings or vanes MNOP, fig. 5, firmly fixed together, and turning freely on a pin driven into the end of the churn staff. The flat part of each vane is cut, so as to be inclined to the plane in which all four lie, in the same manner as the sails of a windmill, as is well explained by figs. 5 and 6. When the beater is moved up and down through the cream, its action upon the oblique vanes causes it to turn round upon a pin above mentioned, as a centre. *a*, Fig. 7, is a small bolt sliding in a groove made in the churn staff, KL; its ends shut into a hole *b*, fig. 5, made in one of the vanes; when this bolt is pushed down, it prevents the vanes from turning round, for the purpose of collecting the butter together at the top of the butter-milk when the churning is done.

PAPERS

PAPERS

IN

CHEMISTRY.

The SILVER MEDAL *of the Society was this Session voted to Mr.* WILLIAM ANDERSON, *of his Majesty's Dock-Yard, Portsmouth, for a Method of painting Linen Cloth in Oil Colours, to be more pliant, durable, and longer impervious to Water, than in the usual Mode.*

The following Communications were received from him, and Specimens of the Cloth and Colours are preserved in the Society's Repository.

SIR,

I BEG leave to lay before the Society of Arts, &c. the following improvements and observations, which I hope will be of service to the public.

Having never heard or read of any method being discovered to prevent paint when laid on canvas from hardening to such a degree as to crack and eventually to break the canvas,

canvas, and render it unserviceable in a short time; and having been an eye-witness for many years of much canvas perishing for want of such discovery in the immense quantities painted for covering seamen's hammocks, and for other uses on board his Majesty's ships; I long had it under consideration to find out such an ingredient as, when mixed with paint, would preserve the canvas and paint laid thereon from the damages above mentioned, and after experiments for a considerable time, I have discovered such an article, and made trial of it with effect above three years.

The canvas I have painted has been submitted to the inspection of the Navy Board, who are so perfectly satisfied with my new method, that general directions are now given to paint all canvas in his Majesty's dock-yards in this manner, which, in addition to the advantages I have before mentioned, actually saves an expense of one guinea in every hundred square yards of canvas so painted, as I have fully stated to them. The ingredient I use is not only serviceable for ships' canvas, but also for canvas designed for paintings, for floor cloths, and for painted coverings within and without doors. I have no doubt of it being applied to many other purposes I am yet unacquainted with; as from actual trials of near four years, I can vouch for its being a preservative to red, yellow, and black paints, when ground in oil and put in casks. When the paints were examined at the expiration of such time, they discovered no improper hardness; but when laid on the work with a brush, they dried in a remarkable manner, without addition of any of the usual drying articles. I still preserve some of these paints for future trials, and I believe this plan of preserving colours will be of essential use to colourmen, and other persons who purchase colours for exportation. The ingredient

dient I use is perfectly simple, being a solution of yellow soap; and the composition for painting is made in the following manner:

To one pound of soap I add six pints of water in a vessel over the fire; in a few minutes after the boiling of the water the soap will dissolve; whilst hot it is to be mixed with oil paint, prepared as hereafter directed, and is then fit for immediate use. The above quantity of soap solution will be sufficient to mix with one hundred weight of paint. The first coat to be laid upon the canvas is to be intirely of this composition, without first wetting the canvas in the usual way. A very small proportion of it, or none, is necessary in the second coat; and the third coat should be of oil paint alone.

The method heretofore practised in his Majesty's dock-yards for painting canvas, was as follows: The canvas was first wet with water, then primed with Spanish brown; a second coat given it of a chocolate colour, made from Spanish brown and black paint; and, lastly, finished with black. This mode is destructive, and more expensive than mine, in the proportion before mentioned. *In my method,* to ninety-six pounds of English ochre ground in boiled oil, I add sixteen pounds of black paint, being one-sixth in proportion of the ochre; this, when mixed, forms an indifferent black. The solution made of one pound of soap and six pints of water, is to be added to this paint, and well united therewith; and without the canvas being previously wet, this composition is to be laid upon the canvas as stiff as can conveniently be done with the brush, and this first coat will form a tolerably smooth surface. The second coat is to be formed of the same proportion of English ochre and

black, without any soap solution; and the third or finishing coat, to be done with black paint as usual.

I am, Sir,

Your obedient humble Servant,

WM. ANDERSON,
Master Painter of H. M. Dock Yard,
at Portsmouth.

Portsea, Oct. 31st, 1806.

SIR,

AGREEABLY to the request in your letter, I have inclosed certificates relative to my new method of painting canvas; and I take the liberty of informing you of a method of obtaining from painted canvas, unserviceable, the whole of the colour laid thereon, and to do it at a very small expense. This I discovered since I last wrote to you, and I believe it will be of considerable advantage to government, who, for want of such a thought, have buried and burnt immense quantities of ships' hammock cloths, when found unserviceable, to prevent embezzlement from taking place. I suggested the idea to N. Diddems, Esq. builder of Portsmouth yard, who communicated it to the Honourable George Grey, Commissioner. I obtained leave to make an experiment, which I repeated thrice, and found that from one ton of painted canvas, unserviceable, I obtained, upon an average, four hundred weight of dry colour, in value to government nine pounds six shillings; the expense of the process not exceeding six shillings.

This

This I effected by calcination, raking aside the ashes and sprinkling them with water, to prevent loss of paint through excess of heat. By passing the calcined matter through a fine sieve, it is perfectly prepared for grinding; it grinds well, possesses a good body for covering with, and dries well with a good gloss. Its increase of bulk, in comparison with common colour of equal weight, gives it the advantage of covering more work. The colours yielded by the calcination of different coloured canvas are as follow, viz. Canvas which has been painted with black paint only, produces a black colour. Canvas finished black, but which has had a previous red or yellow ground, will produce a dark chocolate colour. Canvas painted lead colour, will yield a good dark lead colour.

I am, Sir,

Your obedient humble Servant,

WM. ANDERSON.

Portsea, March 25, 1807.

To C. TAYLOR, M.D. SEC.

Certificates, dated March, 1807, were received from the following persons, viz.

A. STOW, lieutenant and commander of the gun brig Steady, stating, that in the preceding month of October he had received on board his ship a set of hammock cloths, painted after the method invented by Mr. William Anderson, which had been constantly in use since the time above mentioned, and appeared fully to answer the end proposed, of rendering the canvas soft and pliable, of preventing its

cracking, or the paint peeling off, and which in the old method had been a subject of much complaint.

JOHN PRIDY, lieutenant and commander of the Gladiator, and formerly commander of the Dapper, on which latter ship a set of hammock cloths, painted after Mr. Anderson's method, appeared fully to answer the end proposed.

P. F. WYATT, oil and colourman, Portsea, stating that he had seen canvas painted after Mr. Anderson's new method, which, after a trial of sixteen months, remained perfectly soft and pliable, the paint by no means cracking or peeling off, and that the gloss was retained, though it had been exposed to all weathers. He further added, that he had seen the paint prepared by him from old painted canvas found unserviceable, and had worked and painted therewith; that it was, in his judgment, very good, and would answer either on canvas, wood, or iron.

NS. DIDDEMS, master shipwright, Portsmouth dock-yard, stating that Mr. Anderson had proposed to him to obtain, by calcination, from old unserviceable painted canvas, the paint which had been laid thereon; that such experiment was made, and four hundred weight of dry serviceable paint prepared from one ton of such canvas; that he had seen it when ground in oil and laid on work, when it appeared to possess all the properties of good paint, and had therefore been recommended by him to the Navy Board.

SIR,

IN answer to your letter of the 25th of April, in which you informed me that the Committee were desirous that I should furnish them with a sample of canvas painted in the old

old method, and another on my improved plan, I trust that I shall be able fully to comply with their request. In the first place, I have sent a small sample of the residuum of the burnt canvas, fit for grinding in oil for paint, also a piece of canvas painted therewith, marked No. 1; another piece painted after the old method, marked No. 2; another piece painted according to my process, marked No. 3; and, lastly, a piece finished intirely with the new composition, marked No. 4; each sample having received three coats of paint. Upon examining No. 2, you will find it becoming from time to time more stubborn, in consequence of the paint hardening; and when a small ridge is formed in it, by pressing it between the finger and thumb, it will soon discover that it is subject to crack, and by this means permitting the wet to enter it, will soon rot the canvas.

The space of time proper between laying on the new preparation and the second coat, ought to be one entire day; but if saving time is an object, the second coat may be put on the day following the first; for if the canvas is placed in an advantageous situation for drying, the composition will dry or harden so as not to rub off.

Canvas finished intirely with the composition, leaving it to dry one day between each coat, will not stick together if laid in quantities, as you will find by making experiments on the sample No. 4.

Since the Navy Board have given directions for ships' canvas to be painted according to my method, I find, upon calculation, that I have painted upwards of twenty thousand yards since November last, a great part of which has not been hung up for painting and drying more than one week, as no more time could be allowed me, in conse-

quence of ships sailing. My plan was therefore to lay on the composition the first day, to coat it the second day, and leaving one intermediate day, to finish it on the fourth. Three days were then allowed it to dry and harden, and when afterwards taken down and folded together in cloths, containing sixty or seventy yards, they did not stick together.

Having no means of giving information to persons concerned in grinding colours, so well as through the medium of the Society of Arts, &c. I beg leave further to relate how I have, for the last three years, saved the labour of three men out of four in grinding colours with the common mills employed for that purpose. One mill has ever been considered sufficient for a man to turn, whereas one man can now, with perfect ease, turn four mills; this is effected by placing two mills on each side of the winch, so close as only to leave room for the fly wheel to play between them. The spindles of each on either side are locked together by a small iron collar, with a pin passing through it. The distance of the mills thus paired from each, in order for the man's standing between them to turn, is two feet six inches. The distance of the arms of the winch screwed on the end of the spindles on either side, is two feet two inches; the length of the arm is one foot six inches from the spindles to the bar across which the man clasps in order to turn.

Fly wheels at the extremity are impediments. Necessity was truly the mother of invention to me in this case, as I had great demand for paint, and I was not allowed men sufficient for the work in the common way.

Persons will scarcely believe, without seeing the experiment, the ease with which they turn. If a little extraordinary

traordinary motion is first given them, and they are then left alone, they will continue to go round sixteen times; so that a man with one hand may turn them.

I am, Sir,

Your obedient humble servant,

WM. ANDERSON.

Portsea, May 6, 1807.

To C. TAYLOR, M. D. SEC.

SIR,

I HAVE stated to the Admiralty Board the several improvements made by me in paint work, and in consequence thereof they have desired the principal officers of our yard to report to them on their merits. The officers, who have for more than twelve months past daily had the execution of them under their inspection, have recommended the same in stronger terms, and the advantages thereof, to the Lords Commissioners, beyond my statement. I have inclosed to you a certificate relative to the ship Hibernia, which arrived here the 12th of May last, and for which vessel I painted a set of hammock cloths, containing thirteen hundred yards of canvas, in June 1806, after my new method.

I am, Sir,

Your obedient humble servant,

WM. ANDERSON.

Portsmouth, Nov. 27, 1807.

To C. TAYLOR, M. D. SEC.

The foregoing letter was accompanied with a certificate from Captain Hicks, and William Trounsell, carpenter of his Majesty's ship Hibernia, stating, that the hammock cloths on board the said vessel were painted in June 1806, after Mr. William Anderson's method; that they were pliable, and did not crack, nor the paint peel off, and were, in their opinion, preferable to those painted in the common way.

SIR,

I BEG leave to trouble you with a further certificate relative to the merits of my method of painting canvas.

I have also discovered a lead coloured paint, highly advantageous for all iron-work exposed to the weather, and preferable to that commonly made from white lead and black. The preparation is as follows:

Process for Lead Coloured Paint on Iron.

I take a fire shovel, and put a small quantity of common litharge thereon, and place it over the fire. I then take a small portion of flour of brimstone between my fingers, and scatter it over the litharge, when the same is sufficiently warm to give light to it. It is instantly converted to a blackish colour, which, when ground in oil, makes a good dark lead colour. It dries quick, gets remarkably hard, and resists the weather beyond any other lead colour. It will be extremely useful in the Ordnance department for painting guns.

I am, Sir,

Your humble servant,

WM. ANDERSON.

Portsmouth Dock Yard,
Feb. 26, 1808.

To C. TAYLOR, M. D. SEC.

The

This letter was accompanied with a certificate from J. B. Harrison, lieutenant and commander of his Majesty's brig Red-Breast, dated Feb. 26, 1808, stating, that the hammock cloths on board the said vessel were painted by Mr. Anderson, in April 1807, and had since that time been constantly in wear, and exposed to the weather day and night; that owing to this new mode they had been preserved supple, without cracking, and that the paint adhered to them in a far superior manner to the former mode of painting.

FIVE GUINEAS *were this Session voted to Mr.* THOMAS SADDINGTON, *No. 73, Lower Thames Street, for a Cheap Method of Preserving Fruit without Sugar, for House Use or Sea Stores. The following Communications were received from him, and Bottles of Fruits thus Preserved are placed in the Society's Repository.*

SIR,

I SHALL be much obliged to you to lay before the Society of Arts, &c. the inclosed communication, and a box containing the following fruits in bottles, preserved without sugar, namely, apricots, gooseberries, currants, raspberries, cherries, Orleans plums, egg plums, green-gages, damsons, and Siberian crabs. I have also sent some fresh English rhubarb plant, preserved in a similar manner. The same mode is applicable to other English fruits, as cranberries, barberries,

barberries, and many more. This manner of preserving fruit will be found particularly useful on ship-board for sea stores, as the fruit is not likely to be injured by the motion of the ship, when the bottles are laid down on their sides, and the corks kept moist by the liquor, but on the contrary will keep well even in hot climates.

The cheapness of the process will render it deserving of the attention of all families from the highest to the lowest ranks of society. If the instructions I have sent are well attended to, I have no doubt that whoever tries my method will find it to answer his expectation.

I am, Sir,

Your most obedient humble Servant,

THOMAS SADDINGTON.

London, Jan. 8, 1808.

To C. Taylor, M. D. Sec.

A new Method to Preserve various Sorts of English Garden and Orchard Fruits, without Sugar.

Gentlemen,

The general utility, as well as luxurious benefit, arising from the fruit produced by our gardens and orchards, is well known and acknowledged at the festive board of every family; nor is this utility and benefit less manifested by a desire of many persons to preserve them for culinary purposes, in the more unbountiful season of the year; and I am well persuaded that this commendable desire would be greatly

greatly extended in most families, was it not attended with so much expense as is generally the case by preserving fruit in the common mode with sugar, that article chiefly constituting the basis by which it is effected. In addition to the expense of sugar, which is frequently urged as a reason for not preserving, there are other objections to that method, and what I am about to mention cannot be considered as the least, namely, the great uncertainty of success, occasioned by the strong fermentable qualities contained in many sorts of fruit. It may be said by some, that fruit may be preserved for a length of time without sugar by the ordinary mode of baking or boiling, and being closely stopped up, to which assertion I freely assent; but even that method is frequently attended with uncertainty, for if the cork or other means used for keeping the external air out of the vessel becomes dry, or from any other cause the atmospheric air exchanges place with what is impregnated by the fruit, it soon becomes mouldy and unfit for use.

From these considerations, and a desire of preserving fruit at a trifling expense, I have made various and successful experiments of doing it without sugar, and at the same time with a certainty of their retaining all those agreeable flavors which they naturally possess; and it is highly probable that they will keep perfectly good for two or three years, or even a longer period, in any hot climate, by which it appears to become a valuable store for shipping or exportation, as I have exposed them to the action of the meridian sun in an upper room, during the whole of the summer, after they have been so preserved (being done in 1806). I have now the pleasure of laying before the Society specimens of the fruit alluded to.

Process

Process for preserving Fruit.

The bottles I chiefly use for small fruit, such as gooseberries, currants, cherries, and raspberries, are selected from the widest necked of those used for wine, or porter, as they are procured at a much cheaper rate than what are generally called gooseberry bottles. Having got them properly cleaned, and the fruit ready picked, (which should not be too ripe,) fill such of them as you intend doing at one time, as full as they will hold, so as to admit the cork going in, frequently shaking the fruit down whilst filling. When done, fit the corks to each bottle, and stick them lightly in, so as to be easily taken out when the fruit is sufficiently scalded, which may be done either in a copper, or large kettle, or saucepan over the fire, first putting a coarse cloth of any sort at the bottom to prevent the heat of the fire from cracking the bottles: then fill the copper, or kettle, with cold water sufficiently high for the bottles to be nearly up to the top in it: put them in sideways to expel the air contained in the cavity under the bottom of the bottle; then light the fire if the copper is used, taking care that the bottles do not touch the bottom, or sides, which will endanger their bursting; and increase the heat gradually until it comes to about one hundred and sixty, or one hundred and seventy degrees, by a brewing thermometer, which generally requires about three quarters of an hour. For want of such an instrument it may be very well managed by judging of the degree of heat by the finger, which may be known by the water feeling very hot, but not so as to scald it. If the water should be too hot, a little cold may be added to keep it of a proper temperature, or the fire may be slackened. When it arrives at a sufficient degree of heat, it must be kept at the same for about half an

an hour longer, which will at all times be quite enough, as a longer time, or greater heat, will crack the fruit. During the time the bottles are increasing in heat, a tea-kettle full of water must be got ready to boil as soon as the fruit is sufficiently done. If one fire only is used, the kettle containing the bottles must be removed half off the fire, when it is at the full heat required, to make room for boiling the water in the tea-kettle. As soon as the fruit is properly scalded, and the water boiling, take the bottles out of the water one at a time, and fill them within an inch of the cork with the boiling water out of the tea-kettle. Cork them down immediately, doing it gently, but very tight, by squeezing the cork in, but you must not shake them by driving the cork, as that will endanger the bursting of the bottles with the hot water; when they are corked, lay them down on their side, as by that means the cork keeps swelled, and prevents the air escaping out: let them lay until cold, when they may be removed to any convenient place of keeping, always observing to let them lie on their side until wanted for use. During the first month, or two, after they are bottled, it will be necessary to turn the bottles a litle round, once for twice in a week, to prevent the fermentation that will arise on some fruits from forming into a crust, by which proper attention, the fruit will be kept moist with the water, and no mould will ever take place. It will also be proper to turn the bottles a little round once or twice in a month afterwards.

Having laid down the method of preserving fruit without sugar, in as clear and concise a manner as possible, I will recapitulate the whole in a few words, which may be easily remembered by any person. Fill the bottles quite full with fruit. Put the corks in loosely. Set them in a copper, or kettle of water. Increase the heat to scalding for about three

three quarters of an hour; when of a proper degree, keep at the same half an hour longer. Fill up with boiling water. Cork down tight. Lay them on their side until wanted for use.

It may be said as an additional reason as well as cheapness, for using wine, or porter bottles, instead of gooseberry, is the difficulty of obtaining them, even at any price, in some parts of the country, and indeed they are equally useful for small fruit, and answer the purpose quite as well, excepting the little inconvenience of getting the fruit out when wanted for use, which may be easily done by first pouring all the liquor out into a bason, or any other vessel, and then with a bit of bent wire, or small iron meat skewer, the fruit may be raked out. Some of the liquor first poured off, serves to put into the pies, tarts, or puddings, instead of water, as it is strongly impregnated with the virtues of the fruit, and the remainder may be boiled up with a little sugar, which makes a very rich and agreeable syrup.

In confirmation of the foregoing assertions, I now produce twenty-four bottles as samples, containing twelve different sorts of fruit, viz. apricots, rhubarb, gooseberries, currants, raspberries, cherries, plums, Orleans plums, egg plums, damsons, Siberian crabs*, and green-gages—which have all been preserved in the manner above described.

In order to diversify the degree of heat, and time of continuance over the fire, I have done some in one hundred and ninety degrees, and continued them in it for three quarters of an hour, from which experiments it is evident, that the heat is too powerful, and the time too long, as the fruit by that degree and continuance is rendered nearly to a pulp†. In the summer of 1807 I preserved ninety-five

* Apples and pears may be done for shipping, &c.

† Some of these samples of 1807, were done in 180 and 190 degrees.

bottles

bottles of fruit, the expense of which, (exclusive of bottles and corks,) was 1l. 9s. 5½d.; but having some fruit left, it will not be right to judge them at a higher rate than 1l. 9s.; and allowing 5s. for the extra coals consumed in consequence of my not having a conveniency of doing more than seven or eight at a time, and this being done at fourteen different times, it will amount to 1l. 14s. the average cost of which is nearly 4½d. per bottle, exclusive of the trouble of attending them; but if we estimate their value in the winter season, at 1s. per bottle, that being in general as low or lower than the market price, they will produce 4l. 15s. but losing one bottle by accident, reduces it to 4l. 14s. leaving a net profit of 3l. on ninety-four bottles, being a clear gain of nearly two hundred per cent. Another great advantage resulting from this statement will appear by making it an article of store for shipping, or exportation; and I shall submit a few ideas tending to promote such a beneficial object by doing it in large quantities; for which purpose sufficiently extensive premises must be fitted up, with a proper number of shelves, one above another, at a distance of about five inches.

The vessel for scalding the fruit in, should be a long wooden trough of six, eight, or ten feet in length, two or three in breadth, and one in depth, fitted with laths across to keep the bottles upright, and from falling against one another; this trough of water to have the heat communicated to it by steam, through a pipe from a closed boiler at a little distance. The boiling water wanted to fill the bottles with, may be conveyed through a pipe and cock over the trough, by which arrangement, many hundreds of bottles might be done in a short time. It may be prudent to observe that this idea is only speculative, not having been actually practised, but at the same time seem to carry with

with them a great probability of success, and worthy the experiment.

It remains now that I state some reason or object for troubling the Society, whom I have taken the liberty to address with these communications. The first is a desire of publicity, sanctioned by their investigation of the experiments made for preserving fruit without sugar, thereby lessening the expense attending an object of so much public benefit and utility. The second arises from a personal or private consideration; but on this subject I shall only observe, that I wish to throw myself entirely on that protection which has ever characterised the liberality of the Society; and that I shall feel highly honoured if they conceive what I have communicated deserving any mark of their favour.

I am, Gentlemen,

Your most obedient humble Servant,

THOMAS SADDINGTON.

Wood Street, London,
January 1, 1808.

To the Society of Arts, &c.

PAPERS

IN

MANUFACTURES.

The GOLD MEDAL *of the Society was this Session voted to* GEORGE WHITWORTH, *Esq. of Coxwold, near Castor, Lincolnshire, for his Exertions in Manufacturing Ropes and Sacking from Sheep's Wool, to answer the Purpose of similar Articles made from Hemp.*

The following Communications were received from him, and Samples of Ropes and Sacks thus Manufactured are preserved in the Society's Repository.

SIR,

HAVING been so happy as to form from long sheep's wool two descriptions of manufactures, namely, worsted rope, and woollen sack, I conceive their extended use will be of great national benefit. I beg leave, therefore, to offer specimens of both these articles to the Society's attention; and if they meet their approbation, I shall be

convinced that I have done my country a service. I wish to throw them freely open to the public, conceiving that, though I might benefit myself by a more selfish conduct, yet by diffusing the manufacture generally, I shall render great service to many others, which, with a good man, should ever be the first consideration.

Any particular information which the Society may require upon the subject, I will furnish with pleasure.

I have the honour to be, Sir,

Your faithful Servant,

GEORGE WHITWORTH.

Cuxwold, near Caster,
Lincolnshire, March 2, 1808.

To C. Taylor, M. D. Sec.

SIR,

Since I had the honour of addressing the Society, I have received much information from many respectable men in various departments, and I am encouraged to believe that woollen sacking and cordage will be found more generally useful than I had even hoped.

My first expectations led me to suppose they would be adopted by persons engaged in agricultural pursuits, and other departments immediately connected therewith, and that the woollen sacks would answer for the corn factors, in Mark Lane, instead of those made of hemp; and I was convinced by all the persons I advised with, that even to succeed so far would, at the present crisis, be productive of great and happy consequences to this country. I am now led to see this business in a more important light, and think

think I may now venture to calculate upon these articles not being used merely by farmers as a substitute for hemp, in order that hemp may be spared for naval purposes, but I have reason to hope they will in some cases have advantages over it. Worsted ropes for breechings of guns will, from their great elasticity, probably be found more to be depended upon, by yielding in some degree to the recoil of the gun, and less liable to break than hempen ropes: they will also be well calculated for running rigging in particular situations. According to Mr. Luccock, who is, I believe, our best authority, Great Britain produces about 137,000 packs of decidedly long wool, each of 240 pounds weight, and, I believe, full two-thirds of this is at this moment in the hands of the farmers and wool staplers, independent of the quantity now in the first processes of manufacture only; and the time of shearing is fast approaching. A great deal of short wool may be used in manufacturing sacks, and I am of opinion that the manufacturers would gladly devote 15,000 tons to make these articles, particularly when it is known that the woollen ropes, when worn out, will be again useful as wool to the manufacturers, and that it will then serve as well for coarse woollens as if it had not been made into ropes. It occurs to me that a great quantity of hemp will be required to be grown at home, unless we adopt these manufactures; and at a moderate calculation, 15,000 tons of hemp would require more than 7,000 acres of land to produce it; and which quantity of land would produce more oats than would half supply with them this metropolis, besides furnishing many other articles.

The first cost of these ropes will, by their being made from combed wool, be about three pence per pound dearer than hempen ones, but the difference will be more than

twice recompensed by the superior value of the old material after being employed, which I presume will, under all circumstances, be worth nearly two-fifths of the original wool.

I speak of the worsted rope, because I have manufactured another kind of rope from scribbled or carded wool, which can be afforded at even a less price than hempen ropes, but which will not be so durable as worsted ropes, nor perhaps be capable of being again manufactured; nor would it employ so many hands to manufacture, which, whilst so many people in Yorkshire are in great distress for want of work, should be taken into consideration.

I am told by naval men that the sacking will make very good hammocks, and it will be afforded at the same price as the hempen ones now in use.

I am afraid of being thought too prolix, but I am so much impressed with the importance of the subject, and of the great saving to this country of money heretofore sent to Russia for hemp, and of other great benefits which would arise to this nation by adopting the plan I recommend, that I am induced to solicit the attention of the Society to it, as I am convinced that their recommendation would bring them into general use.

I am, Sir,

Your humble and faithful Servant,

GEORGE WHITWORTH.

London, March 8, 1808.

To C. TAYLOR, M. D. SEC.

SIR,

I TAKE the liberty of adding some further particulars on the subject which I had the honour of addressing to the Society.

Society. I have lately made several more experiments upon both the rope and sacking, and am now able to speak with a greater degree of certainty respecting them; and after the polite attention I have experienced from the Society, I should think myself greatly blameable if I did not give you every information in my power upon the subject. I have tried at a breaking machine one of the ropes twenty-four feet nine inches long, and three inches three-tenths in circumference; its weight was eight pounds three ounces, and it bore a weight of one ton thirteen hundred three quarters and sixteen pounds without breaking, but was broken by a weight of one ton fourteen hundred one quarter and twelve pounds. I am much obliged to Mr Stothard, who furnished me with the rope, for his readiness in complying with my wishes. I conceive that for a first attempt this and all the ropes I have exhibited are very good, but the rope-makers in London tell me that they are capable of being made considerably stronger. From the examination of the pile of the broken rope, it appears not to have been sufficiently longitudinally laid, as it stretched to a very great extent, and I suppose, before it broke, was drawn out so as not to be more than two and a half inches in circumference. I am happy to say that the Navy Board, at whose request I furnished some ropes, have desired me to send some wool to the yard at Woolwich, for the purpose of being manufactured there; of course it will there have the advantage of a fair trial, and it will soon be determined whether woollen ropes can be of advantage to the royal navy.

As I have not been at sea, I am not competent to judge with certainty of the merits of either the worsted ropes or sacking for naval purposes, but I will boldly venture to prediet, that in many situations familiar to me, wool wil

be found very superior to hemp; and it will be a great national benefit if we are at once able to give up hemp to the use of the navy.

Wool used upon my plan will furnish employment to manufacturers, who are now in great need; it will relieve the growers of long wool, by taking an article at a fair price, which must otherwise remain a drug upon their hands, and it will give new life and vigour to our internal commerce. The hammock is also under consideration of the Navy Board, and I have the greatest hope that its use will be adopted. I have the most respectable testimony of the value of the woollen sacking for corn bags, from the gentlemen in the corn market, and which I am happy to say was almost on my part unsolicited. I have sent a fresh specimen of the article for your notice. I saw one of the bags, containing about seventeen pecks of wheat, thrown from the shoulder of a tall man upon a boarded floor, without the least injury being done to the sack; which experiment was considered by the persons present to be a proof of sufficient strength for any purpose for which sacks ought to be used.

The sacking will be particularly useful for the bottom of beds, and in many other situations where hemp has heretofore only had a place. The price of worsted and woollen sacking is near one shilling and sixpence per yard, and hempen sacking from one shilling and three pence to one shilling and four pence per yard, twenty-five inches in width.

The rope will I believe be to hemp as follows, in point of weight and value, new and old, of the same size:

17¼ ounces hemp, worth, new, 13d. worth, old, 1d.
12 ounces wool, do. 12d. do. 4d.

Raw materials of both articles taken at 84l. per ton.

Every

Every trial I have made corresponds nearly with the above; and when worsted rope is brought to its greatest perfection, I have no doubt but a rope of any given size will be found cheaper in the first instance than a hempen one, which, added to the advantage in the old material, will be a very weighty recommendation.

I put some very small traces into use about a month ago, and on my return home I found them very firm. My servants told me the extreme wet weather had no effect upon them, and that they had this advantage over hempen ones, that they did not stiffen on drying, but were as pliable and soft as before they were wet. A man of great veracity has informed me that he has used a woollen rope wet and dry, without any extraordinary care, in turning a cylinder from the axis of a water wheel, and that he has found it to wear much longer than any hempen one had previously done in the same time and situation.

I have given woollen ropes of different sorts to some of my neighbours, and I have most favourable accounts from all of them. I could have sent certificates of their worth under the hands of very respectable men, but I hope in a short time the whole country will be acquainted with their value, as I understand a meeting has been called in this neighbourhood, to consider how far they may be usefully adopted in agriculture, and some commercial departments. I believe it is now fully ascertained, that for turning cylinders in all machinery, wool will wear longer, and perform its office better than hemp; and I think that for cranes, coal heaving, and in every situation where there is much friction, wool will be found more durable. I know from experience that almost any ordinary roper may make a rope sufficiently good for the use of the farmer, and for ordinary purposes, after the wool has been once combed

only; and I wish it to be generally known, that there is no difficulty in altering a loom of almost any description in a short time to a sacking loom; and I am of opinion that some of the coarse wool of this island, not considered as decidedly long, would make very good sacking in part, and very useful rope. I shall now conclude my letter, and shall be very proud to have been in any degree useful to my country. I have certainly given a great portion of labour to the cause, and have been at considerable expenses in promoting an object which I firmly believe to be of much importance at this juncture. I beg leave to tender you my best thanks for the attention you have shown me; and if the Society shall consider my experiments worthy of recommendation, I shall then be fully convinced that my time and attention have been directed to a truly desirable object.

I have the honour to be, Sir,

Your devoted humble Servant,

GEORGE WHITWORTH.

Cuxwold, April 23, 1808.

To C. Taylor, M. D. Sec.

CERTIFICATES.

SIR,

We, the undersigned, have examined the woollen sack exhibited by George Whitworth, Esq. and can see no reason to imagine but that it may be rendered in every respect as useful as hempen ones, and at little, if any, additional price; and under the present situation of this country, with regard

regard to Russia, &c. we think it may prove a discovery of national benefit.

ROBERT and JOHN WILSON.
GILES and HENNINGS.
WILLIAM GILLIES.
MATTRASS and FOTHERGILL.
ROBERT and JOHN HEWETSON.
AUGUSTIN GEORGE, jun.
SAMUEL HOLLINGSWORTH.
CHRIS. DUNKIN and J. HAYS.
W. RANDELL.
MATTHIAS WILKS.
J. and W. BURGESS.

Corn Exchange, Mark Lane,
April 13, 1808.

To C. TAYLOR, M. D. SEC.

SIR,

BY desire of George Whitworth, Esq. I send you the sack which was exhibited on our stand at Mark Lane. I am very sorry we could not get a quantity in time to ship clover seed in this season, as that would have distributed them through every part of the country; and the farmers seeing them, might have employed the weavers in their own neighbourhood to manufacture them for their own use, much lower than by procuring them from one particular neighbourhood, and which is the liberal idea of the inventor.

You

You will also receive a piece of the rope, which bore one ton thirteen hundred three quarters and thirteen pounds. I attended the experiment, and found the ropers to be of opinion that they could manufacture one from similar materials much better, this rope having been sent from Lincolnshire. I have very little doubt but that this discovery and application of wool will prove highly beneficial to the farmer, and probably of the greatest importance to the country.

I am, Sir,

Your obedient Servant,

JOHN FOTHERGILL.

No. 22, Colchester Street,
Tower Hill, London, April 26, 1808.

To C. TAYLOR, M. D. SEC.

SIR,

I FEEL much honoured by the inquiries you have made from me, by desire of her Serene Highness the Margravine of Anspach, respecting the mode of spinning the wool for my sacking; and it gives me great pleasure to have an opportunity of affording any information to a lady so distinguished for her endeavours to promote the interest of this country.

As the warp is made of one description of wool, and the weft of another, it requires a different process to bring the former into worsted, from that which converts the latter into yarn. The worsted is spun from combed wool, upon a machine called by the Yorkshire manufacturers a frame. These, in the factories I have seen, are generally so constructed

structed that a boy or girl can conveniently attend about forty spindles; the worsted thread is afterwards doubled and twisted upon another machine, called a twisting frame, and it is then ready to form the warp. The yarn used for weft is made of very coarse wool, and generally rather short: I believe some of the lowest sorts of Scotch wool have been used for this purpose. The wool is pulled or opened by a machine called the willy, and is afterwards passed through the scribbler; it is then carded by another machine, and is ready for spinning by the common spinning jenny, with which a man or woman, by hand, can spin about forty threads at once, assisted by two or three boys, who supply the cardings. I have probably been more explicit than necessary on the subject, but I wish fully to comply with her Highness' request. As you have obligingly offered to accept any addition to my former communication, I shall now observe, that a considerable contract for hammocks is now executing at Doncaster, and I hope they will prove superior to those made of hemp. The woollen sacks and ropes, as far as they have been hitherto tried, have fully answered expectation. The traces and plough lines are as good to appearance after three months constant use, as when new; and worsted waggon ropes, for binding loads of hay or corn, are much approved of by all my waggoners, and were certainly more to be depended upon in the late hot weather, when the hay was excessive dry, than hempen ones. It was obvious to every one, that the loads bound by woollen ropes were brought home more regular and even than the others. I suppose it was owing to the elasticity of the wool that this was effected. I state this, as I think it will give you satisfaction to hear, that what you had formed a favourable expectation of, answers so well.

It is, in my opinion, the duty of every Englishman to consider early the things we can resort to at a time of necessity.

I remain, Sir,
With the greatest respect,
Your obliged and obedient Servant,
GEORGE WHITWORTH.

Cuxwold, August 6, 1808.

To C. Taylor, M. D. Sec.

Five Guineas *were this Session voted to* Mr. Peter Tansley, *at the White Horse, Wheeler Street, Spitalfields, for his Improvement in Cutting Silk Shag Edgings, from whom the following Communications were received. An explanatory Engraving is annexed, and the Implement is preserved in the Society's Repository.*

SIR,

In the latter end of March, 1806, my employer, Mr. Jeffery, of Bow Lane, Cheapside, applied to me with a pattern of silk shag, about six eighths of an inch wide, which he wished to be executed as quick as possible.

Being aware how tedious an operation it was to cut the shag with the trivat, the instrument generally used by the shag weavers for that purpose, I thought I could invent an instrument which would cut it in one-third of the usual time; I therefore drew the plan of one, and gave it to Mr. Baker, a cutler in Artillery Passage, Artillery Street, Spitalfields, to make according to my instructions, which he did, and which answered my expectations in the work.

In

In October, 1806, I made for the same gentleman a figured shag, one inch and three quarters wide, and cut it with the same instrument, as certified by my employer and his son-in-law. I hope the Gentlemen of the Society will not think me too presuming in offering this improvement to their notice.

I am, Sir, with great respect,

Your obedient Servant,

PETER TANSLEY.

White Horse, Wheeler Street, Spitalfields,
April 28, 1808.

To C. Taylor, M. D. Sec.

Reference to the Engraving of Mr. Peter Tansley's *Implement for Cutting Shag. See Plate I. Figs.* 8, 9.

Fig. 8 shows the steel implement or cutter, as placed or woven within the threads, previous to their being cut with it, the cutting being performed by merely drawing out the knife, the sharp edge of which cuts the threads, and forms the shag by that operation.

Fig 9 shows the implement detached from the work, R being the part held in the hand, and s the sharp blade which cuts the threads.

SIR,

This is to certify, that Peter Tansley, of Wheeler Street, is the sole inventor of the cutter for making narrow shag; that its utility is well known; and that I have, within fourteen

fourteen days, made four hundred of these improved instruments.

W. BAKER,

Working Cutler, 13, *Artillery Passage*, *Bishopsgate Without.*

To C. Taylor, M. D. Sec.

Certificates were received from the following persons, stating the very great utility of the instrument, their persuasion of its being superior to any other thing of the kind ever invented, as making the work equally good, with greater ease and in half the time, and that Mr. Peter Tansley is the original inventor.

Thomas Jeffery, 48, Bow Lane, Cheapside.
Thomas Bradley, jun. Chiswell Street.
William Hewitt, 2, Wilson Street, Moorfields.
Thomas Bright, 48, Gutter Lane.
John Farmer, 3, Staining Lane.
W. Ogbun, 11, Beech Street.
Henry Ogbun, Crown Street.
John Ogbun, 75, Sun Street.
Steph. Watters, 37, Wood Street, Cheapside.
John Peter Claret, Hayes Court, Soho.

PAPERS

IN

MECHANICS.

The SILVER MEDAL *of the Society was this Session voted to Captain* WILLIAM BOLTON, *of the Royal Navy, for his Improvement in Jury Masts. The following Communication was received from him, an Explanatory Engraving is annexed, and a Model is preserved in the Society's Repository.*

SIR,

HEREWITH you will receive the model of a plan for fitting ships' jury masts, to be formed from the spare spars usually carried on board King's ships, and in every merchantman that is properly found. By having jury masts so fitted, ships will be enabled to carry as much sail as on the usual regular mast; the great use of which I need not dwell on, only observing that it may be of great importance to fleets after a general action, or when in want of proper lower masts, either at home or abroad, and enable ships, after the loss of their mast, to prosecute their voyage, or service, without any deficiency of sail.

I beg

I beg you will be pleased to lay it before the Society, and I have the honour to be,

Sir,

Your obedient humble Servant,

WM. BOLTON.

His Majesty's Ship Fisgard,
Sheerness, Oct. 31, 1807.

To C. TAYLOR, M. D. SEC.

REMARKS.

IN the model in the Society's possession the main mast is broken about one-third of its length above the deck, proper partners are secured on the deck, in which a hand mast and spare main top mast are fixed on each side of the broken main mast, and secured thereto by two spare caps, morticed on a square made in its centre. A strengthening cap, moveable on these additional masts, connects them, and the upper parts of these masts are secured firmly by trustle trees in the main top. The foot of a spare fore top mast passes through a cap made from strong plank, morticed into the heads of the two temporary masts above mentioned, goes through the main top, and rests in the moveable strengthening cap, which connects those two masts, and enables the fore top mast to be raised to any height which the main top will admit, and be then firmly secured by the upper cap, the main top, and the strengthening cap below it. The fore top mast being thus adjusted, the cross trees and top gallant mast are mounted upon it, which completes the whole business.

Two caps are the only things necessary to be made expressly for the purpose, the other articles being usually ready on board the ship.

Reference

Fig. 4.

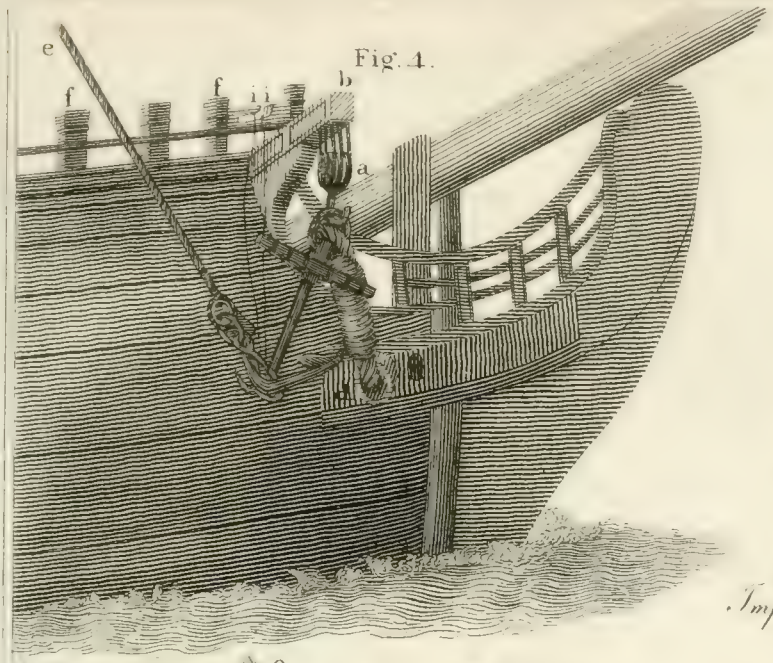
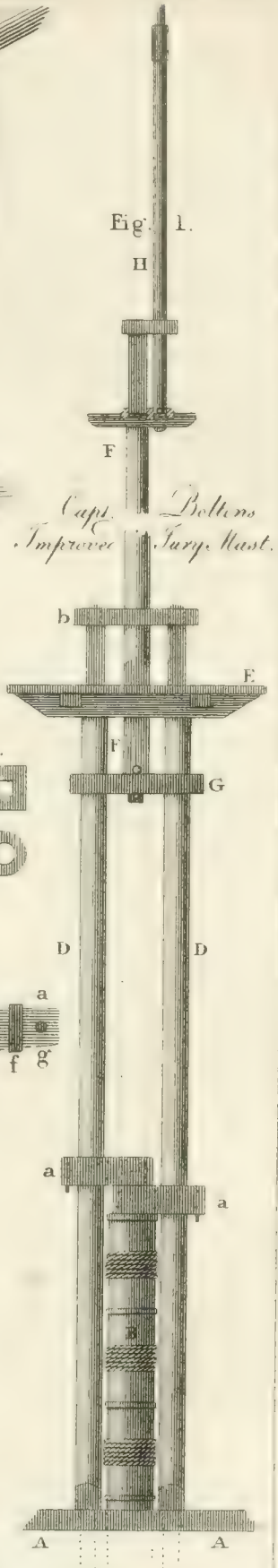


Fig. 1.



Capt. Ball's method of Fishing an Anchor.

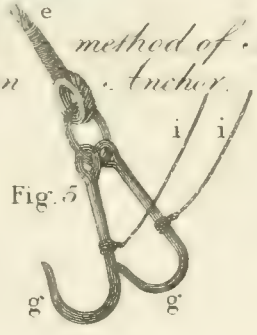


Fig. 5

Fig. 2.

Fig. 3

Fig. 6.

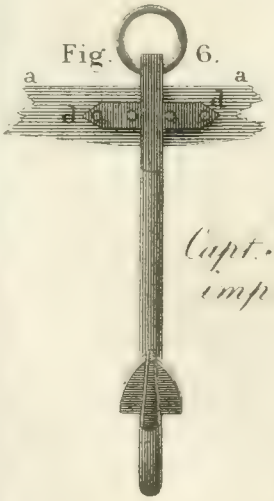
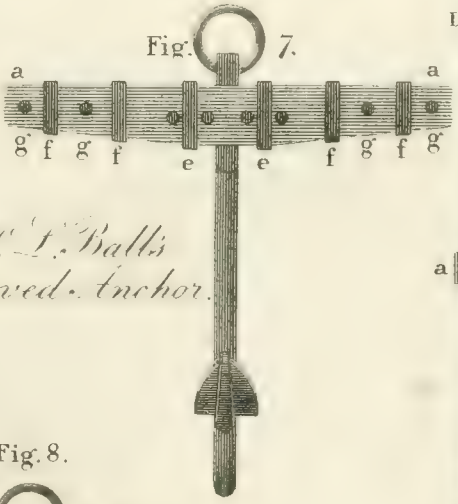


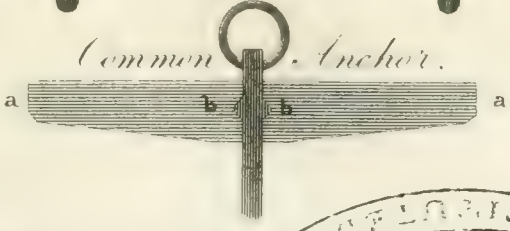
Fig. 7.



Capt. W. L. Ball's improved Anchor.

Fig. 8.

Common Anchor.



Reference to the Drawing of Captain Bolton's Jury Mast. Plate II. Figs. 1, 2, *and* 3.

Figs. 1, 2, and 3, where A A represents the partners or pieces of timber which are bolted to the quarter deck for the mast to rest upon. B is the stump of the lower mast, which is cut square at the top, and of the same size as the head of the mast originally was; upon this square, the main and spare lower caps *a a* are fixed; two mortices must be cut in the partners A A to receive squares made at the lower ends of the two temporary masts D D, which are supported by the caps *a a*, one of them is a spare main top mast, the other a hand mast; these two support the main top E, additional squares being made on the tressel trees to receive each of them. *b* is a cap shown in fig. 2, made of four inch plank doubled for the purpose, and fitted upon the heads of the masts D D, for a fore top mast F F, the heel of which rests in a mortice made in the stump of the lower mast; it is also steadied by a double cap G, separately shown in fig. 3, on which it fids finally on the top. The top-gallant mast H is fixed to the mast F by the top and cap in the usual manner. The figures 2 and 3 show the caps separated from the masts, and are the only things necessary to be made for the purpose; and the object of the cap, fig. 2, is to steady and prevent any wringing of the lower jury mast, and to fid the top mast whenever it is reefed. The fore top mast F F appears in two separate pieces, on account of its length.

The SILVER MEDAL *of the Society was this Session voted to Captain* H. L. BALL, *of the Royal Navy, for an Improvement in Anchors, to render them more durable and safe for Ships, and for his Improved Mode of Fishing Anchors. The following Communications were received from him, explanatory Engravings are annexed, and Models are preserved in the Society's Repository.*

SIR,

THE great expense of timber in the navy for anchor stocks, and the frequency of their failing or giving way in the centre, where the square of the anchor is let into the stock, have induced me to offer to the Society of Arts, &c. a plan of an anchor which may be cheaper in construction, and more likely to hold in various situations than those in common use.

The model I have sent will sufficiently explain my intention, and show how beneficial it may be in strengthening the anchor stocks. I wish much to notice to you its probability of holding in the ground longer than other anchors, on account of the additional weight of the stock; and this will more particularly be the case in banks which shelve suddenly down from the shore, such as at St. Helena, Cawsand Bay, and indeed in most of the islands in the West Indies. The proportion of additional iron, as explained by my model, is in all anchors to be twice and a half the diameter of the shank from each side at the stock, and of course this mode will supply the place of the present nuts, which are only intended to prevent the stock from slipping

in

in and out, whenever it becomes loose, which accident anchors are very liable to in hot climates. My anchor stocks will save a considerable quantity of the finest timber, and give much greater security.

I likewise beg leave to offer to the Society a model of a double fish hook, for the purpose of fishing the anchor, an operation which, in the common mode of doing it, is frequently attended with accidents both to the ship and crew, from the anchor suddenly slipping unexpectedly in raising it to its proper position.

I flatter myself that these improvements will meet with the Society's approbation.

I am, Sir,

Your most obedient humble Servant,

H. L. BALL.

Lower Mitcham, Feb. 13, 1808.

To C. Taylor, M. D. Sec.

Reference to the Engravings of Captain H. L. Ball's *Method of Fishing an Anchor. See Plate II. Figs.* 4 *and* 5.

Fig. 4, Pl. 2, represents Captain Ball's method of fishing an anchor. Fig. 5 shows an enlarged view of his double hooks used for that purpose.

In the usual operation of heaving an anchor, it is drawn up by the cable until it appears above water; the cable will not now raise it higher, it is therefore bowsed up by the cat block *a*, fig. 4, from the cat head *b*, the cable *d* being slackened out as it rises. When it is got up as high as the cat block will raise it, a strong hook, called the fish hook,

fastened to a rope *e*, which is suspended by a tackle from the shrouds, is hooked to the anchor at the bottom of the shank, and thus the arms of the anchor are elevated above the stock, until one of the flukes is brought up to the timber heads *f f*, to which it is made fast by a rope and chain, called the shank painter. In this operation the fish hook sometimes slips and occasions mischief, to remedy which, Captain Ball has applied two hooks instead of one, which keep firmer hold. These hooks are shown upon an enlarged scale at *g g*, fig. 5, attached to the rope *e*; each of these hooks take one of the arms of the anchor, close to the shank, and hold it firmly. *i i* are two small lines made fast to the hooks, to direct them so as to get proper hold of the anchor.

Reference to the Engraving of Captain H. L. BALL'S *Improvement in the Formation of Anchors. See Plate II. Figs.* 6, 7, *and* 8.

This anchor, in external appearance, differs very little from the common anchor; the improvement consists in forming and fixing of the shank of the anchor to the stock. The stock *a a*, figs. 6 and 7, is made of two pieces of oak bolted together, and well secured by hoops. In the common method, in order to prevent the anchor stock from slipping off the shank, a square projection *b b*, fig. 8, is forged upon the shank; this is improved by Captain Ball, as shown in fig. 6, where this projection *d d* is extended on each side of the shank, far enough to receive two bolts through each of these extensions, which bolts hold firmly together the two pieces of timber which form the stock, and secure the stock fast to the shank. Two iron hoops, fig.

fig. 7, *e e*, are driven on the stock between the bolts, and *f f f f* are other hoops, and *g g g g* are tree-nails to strengthen the whole.

The SILVER MEDAL *of the Society was this Session voted to* Mr. THOMAS ROBERTS, *of the Navy Office, for his Improvement in Ship Building, by securing the Ends of the Beams of Ships without Wooden Knees. The following Communications were received from him, an explanatory Engraving is annexed, and a Model and Drawing are preserved in the Society's Repository.*

SIR,

I BEG leave to send you herewith a sketch of the midship section of a 74 gun ship, showing a more effectual method of securing the beams of ships to their sides, and for superseding the necessity of standards, top and breadth riders, and nearly of wood knees altogether, which, after repeated trials, have been found fully to answer the intended purpose, and for which invention I have been rewarded with a premium of 800l. by the King's Order in Council of the 18th of October last, on the recommendation of the Lords of the Admiralty, and the Honourable Commissioners of his Majesty's Navy, which I wish to be laid before the Society of Arts, &c. if you think the merits of it worthy their notice. As the subject has not been published, I hope it will appear deserving of some mark of the Society's approbation; and in order to show that it is not a speculative

business: I beg leave to subjoin a list of ships that have been built, and are now building, agreeably to this mode.

I am, Sir,

With the greatest respect,

Your humble servant,

THOMAS ROBERTS.

Navy Office, May 3, 1808.

To C. Taylor, M. D. Sec.

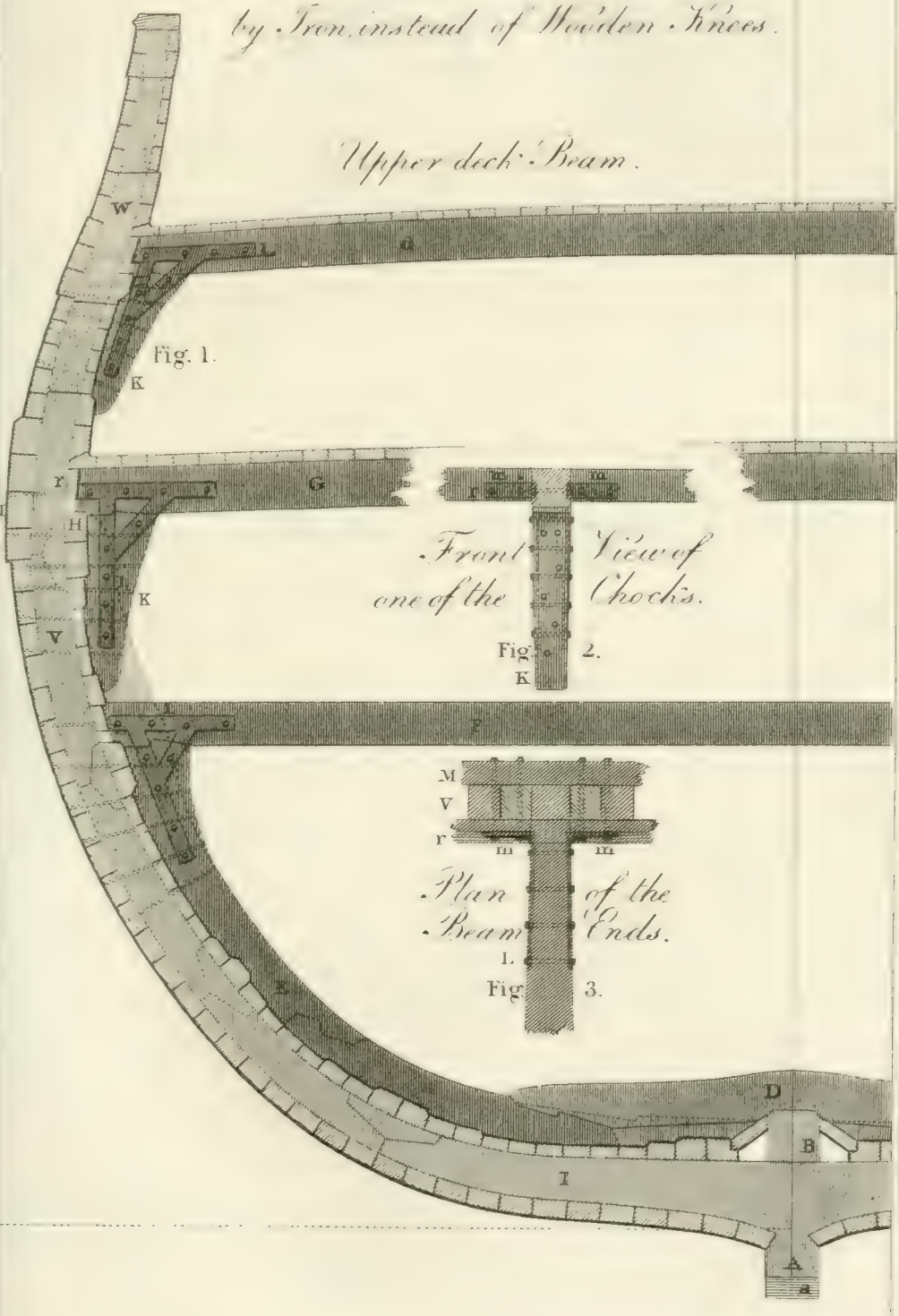
A List of Ships Built and Building for his Majesty's Service, whose Beams are secured on a Plan proposed by Mr. Thomas Roberts, *Assistant Surveyor of his Majesty's Navy.*

BUILT.

Ships' Names.	*Guns.*
Lively	38
Melampus	36
Jason	32
Hebe	32
Circe	32
Pallas	32
Alexandria	32
Thames	32
Resistance	38
Spartan	38
Undaunted	38
Valiant	74
Elizabeth	74
Cumberland	74
Venerable	74
Aboukir	74

NEARLY

Mr. T. Roberts's Method of attaching the Ends of the Beams of Ships, to their Sides by Iron instead of Wooden Knees.



J. Farey jun.r del.

Engraved by J. Farey

NEARLY COMPLETE.

Ships' Names.	*Guns.*
Caledonia	120
Milford	74
Cornelia	32
Nereus	32
Bucephalus	36
Semiramus	36
Dolphin	44

BUILDING.

Ajax	74
Conquestadore	74
Vigo	74
America	74
Berwick	74
Vengeur	74
Scarborough	74

Reference to the Engraving of Mr. ROBERTS' *Method of applying Iron Knees to connect the Ends of the Beams to the Sides of Ships, Pl. III. Figs.* 1, 2, *and* 3.

Fig. 1. the one half of a midship section of a large ship. A is the keel, with the false keel *a* beneath it. B the kelson, D chocks bolted thereto, to retain the opposite pieces of the riders E firmly together; F one of the orlop beams, G one of the lower deck beams, and *d* one of the upper deck beams; H are the clamps which sustain the extremities of the beams, I the floor timbers laid across the keel and bolted to it, V the several futtocks, and W the top timbers, which are all united into one frame. K are the wooden chocks bolted to the ship's sides, and L are the iron

knees by which the beams are made fast to the chocks; these knees are also bent and bolted to the ship's sides, as shown by L *m m* in figs. 2 and 3. In fig. 3, which is a plan of the beam ends, M is the outside plank, V the timbers, and *n* the filling between the timbers.

The bolts for the chocks and iron knees go through all these as shown by the dotted lines. The dimensions of the iron knees are as follows:

Upper deck flat iron knees, breadth four inches and a half, thickness one inch.

Lower deck iron knees, breadth five inches, thickness one inch and an eighth.

Orlop iron knees, breadth five inches, thickness one inch and an eighth.

CERTIFICATES.

SIR,

We feel ourselves called upon by a strong sense of the necessary attention due to the merit of an individual, to state to you, for the information of the Right Honourable the Lords Commissioners of the Admiralty, the great utility which has resulted to his Majesty's service, from a method of fastening the beams of ships to their sides, to which resource we have found it absolutely necessary to resort, from a general failure of the supply required of wood knees.

This contrivance is the invention of Mr. Roberts, assistant surveyor of his Majesty's navy, and has been found, after repeated trials, to answer the purpose for which it was intended. We consider it as an object of great importance in ship building, and we therefore beg leave to recommend

commend to their Lordships' consideration, that a premium, (such as may in the judgment of their Lordships be a just reward for an invention of so much utility), be granted to Mr. Roberts, as a reward for his thus contriving a substitute so beneficial, and as an encouragement to others, to exert their inventive powers in producing works of similar worth.

We remain, &c. &c. &c.

THOS. B. THOMPSON.
W. RULE.
HENRY LEGGE.

Navy Office, Sept. 27, 1806.

To WILLIAM MARSDEN, Esq.

At the Court at the Queen's Palace, the 28th October, 1807.

PRESENT

The King's Most Excellent Majesty in Council.

WHEREAS there was this day read at the Board, a Memorial from the Right Honourable the Lords Commissioners of the Admiralty, dated the 27th of this instant, in the words following, viz.

May it please your Majesty,

The principal Officers and Commissioners of your Majesty's Navy, having represented to us, by their letter of the 27th September, 1806, that they felt themselves called upon by a strong sense of the merits of an invention of Mr. THOMAS ROBERTS, assistant to the Surveyors of your Majesty's Navy, for fastening the beams of ships to their sides, to which expedient it was found absolutely necessary

to

to resort, from the general failure of the supply required of wooden knees, to represent that the invention has been found, after repeated trials, to answer the purpose for which it was intended; and is considered as an object of great importance in ship building.

And the said principal Officers and Commissioners having, by their letters of the 20th and 24th of this month, confirmed their former opinion of the utility of the contrivance, and after earnestly recommending that some reward should be granted to Mr. Roberts, set forth they are of opinion the sum of eight hundred pounds will be a proper recompense.

We have taken the same into our consideration, and concurring in opinion with the Navy Board as to the ingenuity of Mr. Roberts' invention, and the advantages that may reasonably be expected to be derived from it, do most humbly propose to your Majesty, that your Majesty will be graciously pleased to authorise us to direct the Commissioners of your Majesty's Navy, to present him with a sum not exceeding eight hundred pounds, as a reward for the same.

His Majesty having taken the said memorial into consideration, was pleased, by and with the advice of his Privy Council, to approve of what is therein proposed:—And his Majesty doth hereby authorise the Lords Commissioners of the Admiralty to direct the Commissioners of his Majesty's Navy to present the said Mr. Thomas Roberts with a sum not exceeding eight hundred pounds, as a reward for the invention.

W. FAWKENER.

(A Copy.)

GENTLEMEN,

HIS Majesty having been pleased, by his order in council of the 25th inst. upon our humbly laying before his Majesty the representation which you had made to us, of the merits of an invention of Mr. Thomas Roberts, assistant to the Surveyor of the Navy, for fastening the beams of ships to their sides, the utility of which invention has been found, after repeated trials, to answer the purpose for which it was intended, and is considered an object of great importance in ship building, to direct that a sum be presented to the said Mr. Roberts, not exceeding eight hundred pounds, as a reward for his invention. We send you herewith a copy of his Majesty's order in council aforementioned, and do hereby desire and direct you, in pursuance thereof, to cause the sum of eight hundred pounds to be presented to the said Mr. Roberts, as a reward for his invention.

We are,

Your affectionate Friends,

R. BICKERTON.
W. JOHNSTONE HOPE.
R. WARD.

Admiralty Office, Oct. 30, 1808.

(A Copy.)

The

The SILVER MEDAL *of the Society was this Session voted to Major* CHARLES LE HARDY, *of the Island of Jersey, for his Invention of a Telegraph. The following Communication was received from him, an explanatory Engraving is annexed, and a complete Working Model is preserved in the Society's Repository.*

SIR,

HAVING discovered a mode of communicating by signals, which to me seems to unite every advantage that can be expected for that mode of communication, I beg leave to transmit to you a plan of it, and to write a few explanatory lines upon the subject.

The telegraph, of modern invention, is an improvement on communication by signals, which has been in use for many ages. Monsieur Chappe was, I believe, the first who proposed a machine for that purpose, which was put in execution about the year 1793. Since that time several modes have been proposed by different persons, none of which seem to have fully attained the object. A machine of this kind should be simple and easy to comprehend. All those which have come to my knowledge are executed by combinations, which render them too complicated for common use, and therefore liable to many errors. That which I now submit to your consideration, seems to me to have removed every objection of the kind; it is simple, easy to comprehend, and extensive in its means; its combinations, which by simple numeration may be carried to 40,000, might with ease be extended to almost infinite numbers;

Major C. Le Hardy's Telegraph.

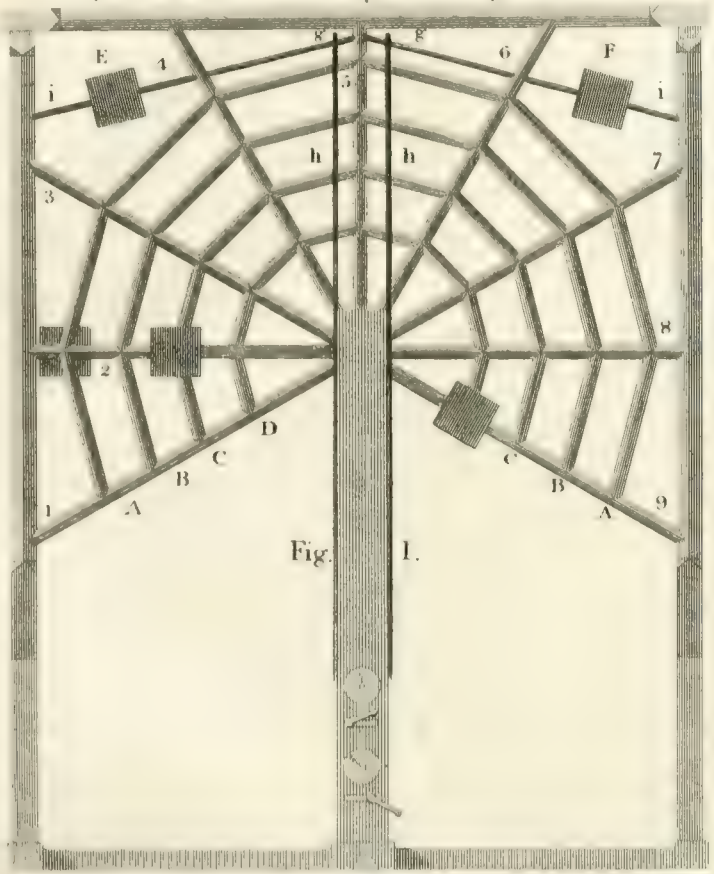


Fig. 1.

Fig. 3.

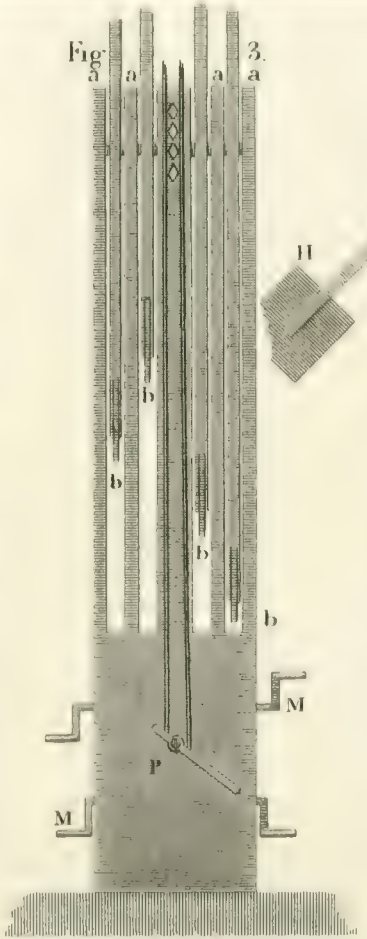
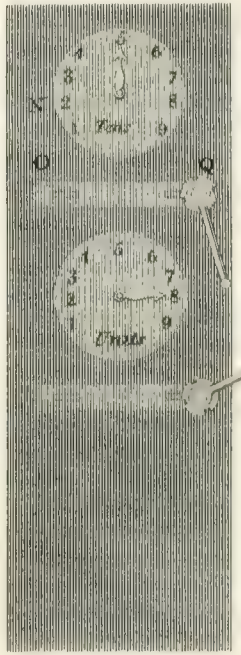


Fig. 2.

Index.

Fig. 4.



numbers; but the present seems sufficient to answer every purpose. All the words in Entick's Dictionary amount to about 25,000; every one of which may thus be numbered. With how much more dispatch would a letter be communicated by signals which express words, than by signals which express only letters. Words may be forwarded as fast as they can be looked for in a dictionary; and even whilst only an equal number of letters could have been communicated by the present mode. Another advantage resulting from the use of words in telegraphic correspondence is, that the words of the same meaning in the several languages having the same number, correspondence may be carried on from one language into another, which though not grammatically correct, yet would be sufficiently intelligible.

Proper names must be spelt, which may easily be done, every letter having a corresponding number.

Though the use of telegraphs has to this time been confined to military purposes, yet a machine of this kind is well adapted to accelerate commercial communication from one end of the kingdom to the other. The arrival, the departure of vessels, the various transactions of commerce, might be speedily announced, to the very great advantage of trade. By this method inaccessible places might communicate their wants, and correspondents, though at a distance of five or six miles, might erect them for a trifling expense. I made the experiment with one of eight feet by ten, and with the use of a telescope, I took down every number from a distance of a mile and a half.

I remain, Sir,

Your most obedient and humble Servant,

CHARLES LE HARDY.

London, Jan. 13, 1808.

To C. Taylor, M. D. Sec.

Reference

Reference to the Engraving of Major C. Le Hardy's *Telegraph. See Plate IV. Figs.* 1, 2, 3, *and* 4.

This machine is intended to express numbers, which may be seen at a distance, and to which words may be referred at pleasure.

Fig. 1 represents a front view of the machine—it is composed of nine bars or radii, answering to the nine figures of arithmetic, as numbered in the plate. The four polygonal or concentric bars, A. B. C. D. which intersect the radii, are for the decimals; thus A stands for units, B for tens, C for hundreds, D for thousands. Over each of these concentric bars or circles, an index, as that marked H, fig. 2, traverses, which marks the number of thousands, of hundreds, of tens, and of units, as far as ten thousand; for instance, if it is required to make the number 9202, turn the hand H in the circle D of thousands to the radius 9, then the hand H in the circle C of hundreds to the radius 2, then, as there are no tens, turn the hand to the radius 2, upon the circle A of units; but as ten thousands are not sufficient to express the number of words in the English language, two square boards are added in the corners, of which that marked E is equal to 10,000, that marked F to 20,000, and both being shown together, are equal to 30,000, which, with the numbers made on the circles, bring it up to 40,000, which number is more by many thousands than all the words in the English language.

Fig. 2 is a view of the mechanism which works the signals round: this is done by means of a rack wheel at I, upon which is firmly fixed the hand with its signal board H; this wheel is made to revolve by means of a rack L, which

which being raised or lowered, makes it go backwards or forwards; this rack is set in motion by the pinion K, to which is fixed a winch, as M, fig. 3. To prevent the necessity of inspecting the signals, the wheel I, to which is fixed an index, as at N, fig. 4, is added, which revolving in the same time as the signal board H, marks the number of the decimal, so that it may be worked correctly from within doors. O, fig. 4, is a bolt to stop the hands at any given point, by means of a wheel with four notches Q fixed to the pinion. Fig. 3 is a side section of the machine, the lines a a a a represent boards, upon each of which is fixed the mechanism, fig. 2. b b b b are the hands and signal boards, one of which is shown at H, fig. 2. The square boards E and F, fig. 1, are fixed upon iron bars which pass through the bars or radii 4 and 6, and have each of their ends made to move in holes in the radius 5, and in the frame at i i, fig. 1, upon which they turn a quarter round, by means of cross bars at g g, to each end of which ropes or wires h h are fastened, and which are connected with two levers, one of which is shown at P, fig. 3, the raising or depressing of which makes them appear or disappear as required.

The

The SILVER MEDAL *of the Society was this Session voted to the* CHEVALIER A. N. EDELCRANTZ, *President of the Academy of Arts, and Superintendant of his Swedish Majesty's Buildings in Sweden, for a Telegraph of his Invention. The following Communications were received from him, an explanatory Engraving is annexed, and a complete Working Model is preserved in the Society's Repository.*

DEAR SIR,

SINCE I left London two years ago, my time, by different occupations, has been almost drawn away from those pursuits which were formerly the dearest objects of my attention, and which procured me the honour of being elected a member of the Society of Arts, &c.

Nothing, however, Sir, shall interrupt those sentiments of gratitude or respect which I owe to the Society, and which, on every occasion, I shall be happy to prove.

I have sent, by Mr. MURRAY, of Leeds, a model of the telegraph which I contrived in Sweden twelve years ago, and which since that time has been in constant use on both sides of the Baltic, besides other places in this country. Its office near the Baltic consists chiefly in facilitating the communication of posts between Russia and Finland on one side, and Sweden and England on the other; and in that respect I dare flatter myself that it has not been quite useless to your country. I shall esteem it a favour if the Society will accept the model I have sent, with two printed publications descriptive of this machine, one in the Swedish, the other in the French language, as a small proof of my

respect

respect and desire to promote the great views of the Society, for the general benefit of mankind.

I have the honour to remain, with great sincerity and esteem,

Dear Sir,

Your most obedient humble Servant,

A. N. EDELCRANTZ.

Stockholm, Nov. 25, 1806.

To C. Taylor, M. D. Sec.

Dear Sir,

In the month of September, 1794, I commenced my experiments on telegraphs. The first I constructed was much upon the French plan, but I have since given the preference to my present telegraph, which occupies less space, and the signals by it are made quicker, easier, and with more clearness and certainty of sight. My telegraph contains ten shutters or vanes in three vertical ranks, the centre one of which having four. By means of this construction 1024 changes or signals may be clearly shown. It would be possible, by this machine, to show 4,037,912 changes; but the attention required in such case would occasion much uncertainty, because it would then be necessary not only to observe what vanes are visible, but to attend also to the order in which they are exhibited.

To express certain words which frequently occur in correspondence, I prefer such signals as by their form may be most easily recollected. These I called fixed signals, because they form phrases of themselves, and shorten the correspondence, they may be easily known by examining

the numbers of a table, previously constructed, and referred to by the signals.

It is necessary that the telegraph should be placed above the level of the horizon, to prevent any object behind from rendering the vanes obscure. The vanes should be painted black, and the intervals between them greater than their diameters, that the vanes may be more clearly distinguished. The frames which support the vanes should be painted white or red, in order to make a better distinction betwixt them, and to show the vanes more clear.

One person is sufficient to manage a telegraph constructed on my plan, particularly at the two extreme ends of the stations, and when the telescope, as should always be the case, is fixed so near to the person who works the telegraph, that he may, at the same time, look through it, and also work the vanes; but for greater certainty, and for intermediate stations, where observations should be made with two telescopes, and in contrary directions, there should be two persons to relieve each other occasionally in the observations; this will require no particular genius, for any person will be capable to manage the business, who knows how to write numerals, and to add together 1, 2, 3, 4.

In trials which I have made for a year and a half, I have frequently employed children, who in a few hours have been sufficiently instructed, and capable of practice.

It is with this view that I have, in the construction of my telegraph, made some sacrifice in its power, to its simplicity of practice. In the working of my telegraph, six signals are usually given in one minute. For a more explicit explanation of this subject, I refer you to the two following publications, entitled, *Abhandlung om Telegrapher och Fiërsök til en ny Inrättning dëraf*, in the Swedish language, 1796, and *Traité des Télégraphes, et Essai d'un nouvel*

Sir A. I. Edelcrantz's Telegraph

Fig. 1.

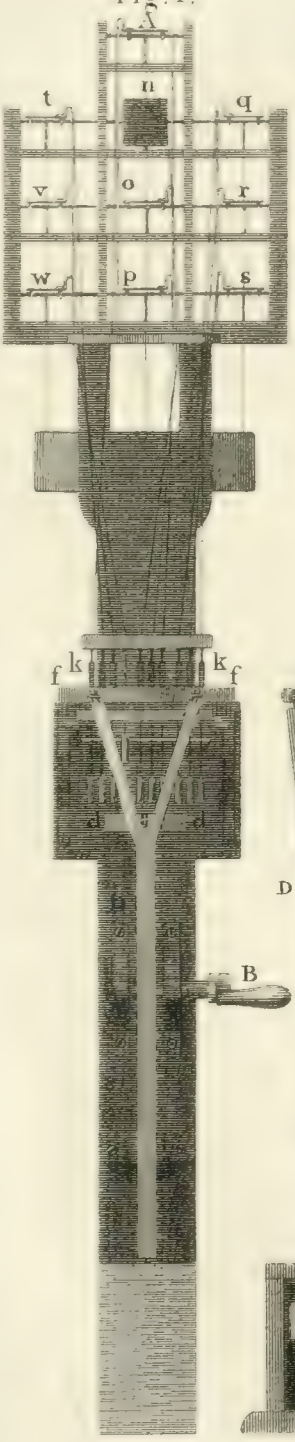


Fig. 2.

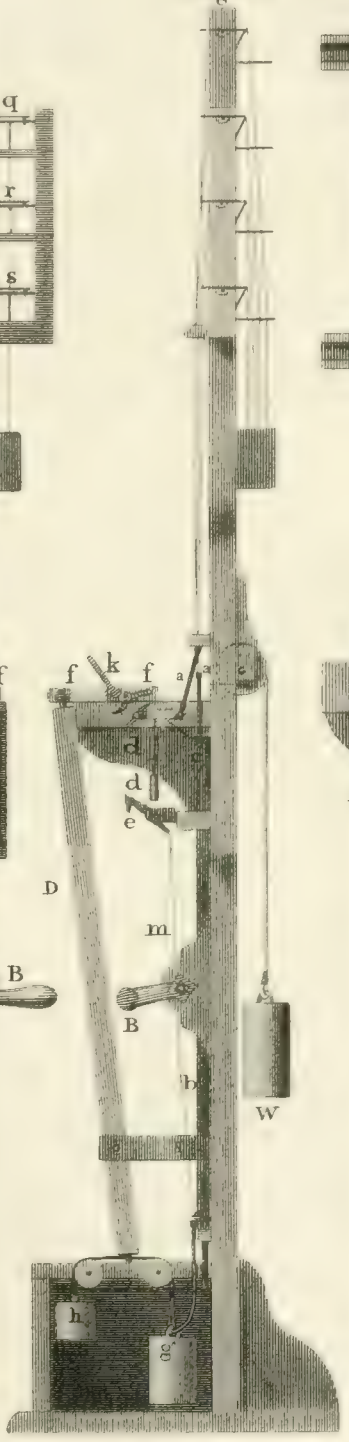


Fig. 3.

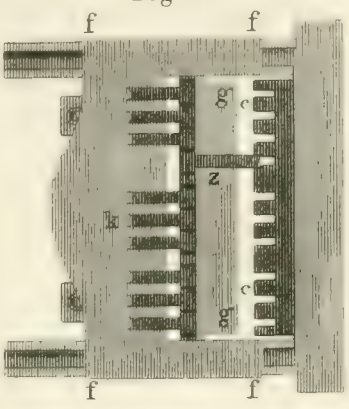
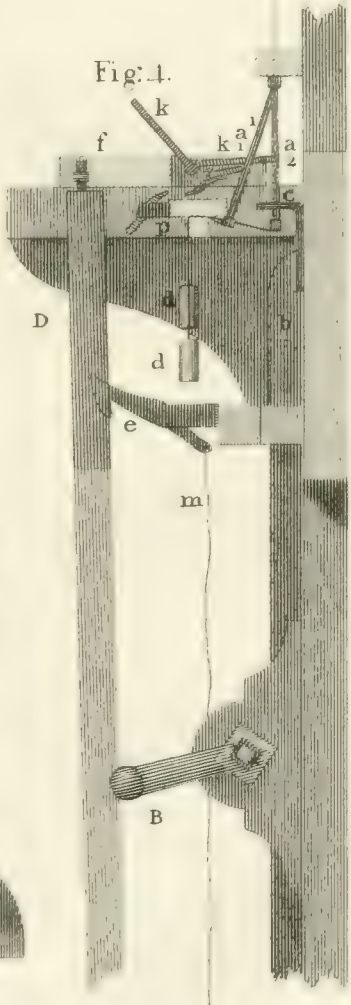


Fig. 4.



TORONTO ATHENÆUM
ASTRONOMICAL

nouvel Etablissement de ce Genre, 1801, in the French language, where every circumstance relative to their construction and management is fully detailed, and will, I hope, be found very satisfactory.

I remain, dear Sir,

Your most obedient humble Servant,

A. N. EDELCRANTZ.

Stockholm, July 1, 1807.

To C. Taylor, M. D. Sec.

Reference to the Engraving of Sir A. N. Edelcrantz's *Telegraph. See Pl. V. Figs.* 1, 2, 3, *and* 4.

The telegraph, or that part of the machine by which the signals are made, is composed of three vertical rows of flat vanes or indexes, similar to those used in the English telegraphs. The middle row of indexes has four, A *n o p*, and the two outside rows three indexes each, q r s, t v w, the fourth of the middle row is above all the rest A. The machine for giving motion to these indexes is exhibited in Pl. V. figs. 1, 2, 3, and 4; each index has a crank to it, a line or wire is made fast to the crank, and comes down from the telegraph to the machine; *a a*, figs. 2 and 4, represent short cylindrical rods, having a button or knob screwed at each end; the above mentioned lines or wires, after passing through holes made in a fixed piece of wood, are fastened to the rods *a a*, figs. 1, 2, and 4, by means of the screwed buttons, and by drawing these down, the signal boards will be turned upright, but when the rods are released, the action of a weight attached to each signal board by a wire, turns the signal boards edgeways, as in figs. 1, 2, and 4;

b is a wooden bar, which is drawn downwards by a rope coiled round a barrel turned by the winch B, and upwards by means of a weight W, fig. 2. The upper end of the bar *b*, has a piece of iron plate c, (a plan of which is seen in fig. 3), into which are cut slits to receive the rods *a a* above their lower knobs; and thus when the handle B is turned, it draws down the rods *a a*, and moves the signal boards, as shown at *n*, fig. 1. Each of the rods *a a*, has a small string and weight *d* attached to it by means of its lower screwed button, the action of which causes the rods to assume the position *a* 1, fig. 4; in this situation they are clear of the range of the iron plate *c*, and will not be affected though it is moved up and down. f f and c, (in all the figures, and seen in plans in fig. 3), is a frame sliding in grooves to and from the rods *a a*; it is moved by a lever D, which receives its motion in the following manner; a weight g, fig. 2, is fastened by a short rope to the end of the bar *b*, it is also tied to a rope which passes over a pulley, is then fastened to the end of the lever D, goes over another pulley, and has a weight *h* suspended from it; now, when the bar *b* is drawn up, it takes the weight *g* with it, the weight *h* then acts upon the end of the lever D, and throws the frame *f f* towards the rods *a a*; upon the descent of the bar *b*, the weight *g* is thrown upon the small rope, and as it is heavier than *h* is, draws it up, and moves the frame *f* from the rods *a a*. The frame *f f* has a spindle in it, upon which are mounted ten keys *k*, and which have angular gaps or notches in their ends, answering to the intervals of the rods *a a*. These keys are marked with figures, each denoting the signal board, whose rod *a a* is opposite to it; the keys turn on the spindles, and when turned up as k, in figs. 2, 3, and 4, are not in use, and do not affect the machine; but when any particular one is thrown down, as z, fig.

z, fig. 3, it pushes before it, in its angular notch or cleft, that rod *a* 2, fig. 4, which is opposite to it, into the correspondent slit in the plate *c*, as represented in fig. 4; a latch *e* catches the lever D, and prevents its return, though the bar b is drawn down by the handle A taking the rod *a* 2 with it, and making the signal; when the bar b arrives at the bottom of its motion, a wire *m* made fast to the end of the bar *b*, and to the tail of the latch *e*, raises the latch and allows the weight *g* to draw back the lever D and frame *ff*, into the position fig. 2; in its motion a small catch *p*, fig. 4, seizes a tail upon the plate *g*, (figs. 3 and 4,) which moves upon pivots in the frame *ff*; and as the frame recedes from the rods *a a*, the catch raises up the plate *g* upon its pivots, and thus lifts up all the keys which are in the position k 1, and puts them in the position *k*, ready for another signal. The great advantage of this contrivance is, that by the powerful leverage afforded by the winch and barrel, one man is enabled to move any number, or even the whole of the shutters at once, and to retain them in that situation, be the weather ever so boisterous, until the signal is answered; which is the more necessary in this telegraph, on account of its greater number of vanes or indexes; but which cannot be done in the government telegraphs in England, even with their more limited number of vanes, without employing several persons at each telegraph.

The SILVER MEDAL *of the Society was this Session voted to* MR. ROBERT RICHARDSON, *of Keswick, in Cumberland, for his Method of raising large Stones out of the Earth. The following Communications were received from him, an explanatory Engraving is annexed, and one of the Implements is preserved in the Society's Repository.*

GENTLEMEN,

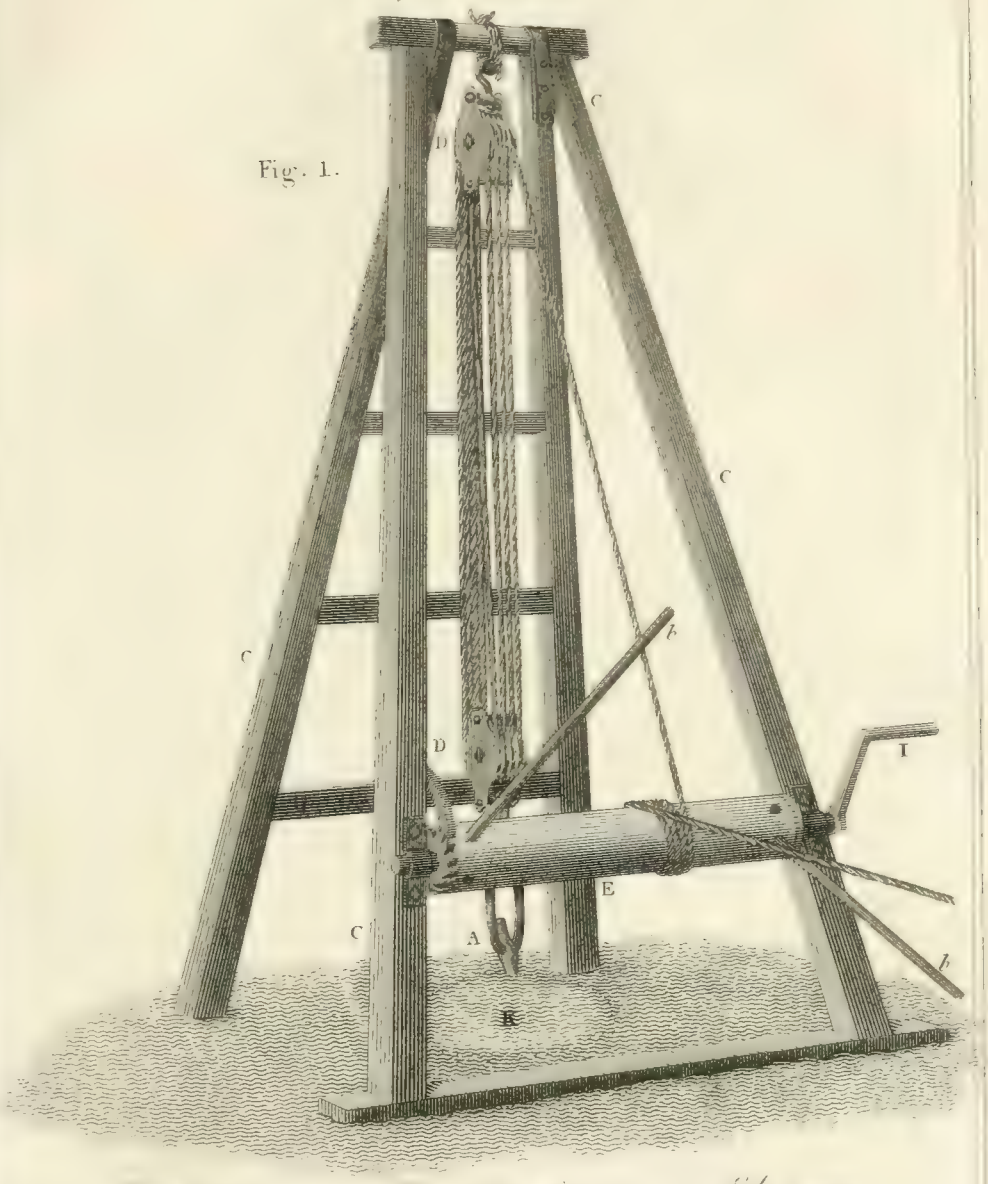
I, ROBERT RICHARDSON, of Keswick, in the parish of Crosthwaite, and county of Cumberland, beg leave to inform you, that I have found out a method of taking large self-stones out of the ground in a very expeditious manner, and that by this means two men will take as many stones out of the ground in one day, as would require twelve men in the usual way of blasting, and afterwards using large levers, &c.

Where stones of from two to four tons each are to be taken up, two men will raise as many as twenty men in the usual way. The work is done by the power of a tackle, but by my method of fixing the tackle to the top of the stone, by the plug which I have invented, it will hold till the stone is pulled out of the ground, and laid upon the surface, or upon a carriage, if required, all which can be done in a very little time.

Stones of four tons weight, or upwards, may be taken out of the ground within the time of five or ten minutes, by two men, without any earth or soil being previously taken from around them, or without any digging with hacks or spades. J. C. CURWEN, Esq. of Workington, has

Mr. Richardsons method of raising large stones out of the Earth.

Fig. 1.



Front view *Perspective view* *Edge view*

Fig. 2.

Fig. 3.

Fig. 4.

J. Farey Junr. delin.

has seen and approved of my performance with this invention, and if the Society should think it deserving of a premium, it would ever be gratefully acknowledged by

Gentlemen,

Your most obedient humble Servant,

ROBERT RICHARDSON.

Keswick, Feb. 8, 1808.

To the Society of Arts, &c.

DEAR SIR,

I CANNOT suffer Mr. RICHARDSON's letter to be sent to the Society without adding a few lines concerning it. I can bear ample testimony to the ease with which the largest self-stones are lifted by his method. I have seen one upwards of five tons lifted by four men. One of the plugs is sent for the inspection of the Society. There is no difficulty in cutting the hole to receive it, the only care is not to make it too large. It is difficult to explain the theory of its action; the least stroke laterally disengages the stone. In many situations it is likely to be of great use, not only in drawing stones out of the ground, but in making weirs and embankments, where the stones are only to be lifted a moderate height.

One of my farmers in Westmoreland has made great use of one, and speaks of it in high terms. I have exhibited it to numbers of persons, who could not believe its power till they saw it tried.

Mr. Richardson submits its examination to the Society, and I conceive it will be very useful and beneficial in cases of new inclosures of land. I do not think it would answer

for soft stones, or safe to use for raising stones in buildings, it being so easily disengaged by any lateral blow. By adding wheels to the tackle machine, or having it upon a sledge, a great deal of time and trouble would be avoided. I purpose to employ this method next summer in making an embankment against the sea; the facility it will give in raising and removing large stones, will expedite the work greatly. If any further certificates of the performance of this plug be required by the Society, I will with pleasure transmit them to you. I will answer for its extracting any stone not exceeding five tons weight out of the ground, without any previous moving of the earth; and it is of importance to preserve large stones entire.

I am, with respect, dear Sir,

Your obedient humble Servant,

J. C. CURWEN.

Workington Hall, Feb. 19, 1808.

To C. TAYLOR, M. D. SEC.

SIR,

I AM favoured with your letter, desiring my opinion of the utility of the iron plug invented by ROBERT RICHARDSON, of Keswick. That which I use is about six inches long, and one inch and a quarter in diameter; it requires a hole of its own size, only two inches deep; the plug is to be driven in a little short of the bottom, and will raise a stone of six or eight tons, with the assistance of three men, in the course of ten minutes after the hole is prepared; and I do not hesitate to say, that three men, thus furnished, will

will clear the ground of large stones in less time, and more effectually, than twelve men by any other method yet come to my knowledge. The plug should be made of good beaten iron. The simplicity and cheapness of the whole apparatus is a great object, as a good plug of the size I use will only cost two shillings and sixpence. I am fully of opinion, that by adding more and stronger ropes and pullies, work might be done by it to an amazing extent. I have reaped great advantage in my farm from the aid of the iron plug, and in justice to the inventor, am happy in thus vouching for its extreme usefulness. Several of my respectable neighbours have experienced the aid and benefit of the above instrument, and will vouch, if required, for the truth of the above statement.

I am, Sir,

Your truly obedient Servant,

ROBERT WRIGHT.

Rose Gill Hall, near Shap, Westmoreland,
May 9, 1808.

To C. Taylor, M. D. Sec.

Reference to the Engraving of Mr. Richardson's *Invention for raising large Stones out of the Earth. See Pl. VI. Figs.* 1, 2, 3, *and* 4.

Fig. 1, K, shows the upper part of a stone nearly buried in the earth, having a hole made in it three inches and a half deep, and one inch in diameter, by means of a miner's jumper; the cylindrical tail of the plug *a*, figs. 2, 3, and 4, which is of the same size, is driven fast into it, by means of

of a hammer applied upon the head of the plug at G. This plug, in its whole length, is nine inches, and has a hole made in its broad part H, through which the oval iron ring B passes easily, and on which the plug can move backwards and forwards, when the ring is hung upon the hook of the lower pulley block of the lifting tackle. C C C C represent the four legs or frame work of the quadrangle; D a five-fold tackle, with blocks ten inches in diameter; E a roller seven inches in diameter, turned by two long iron levers b b; the handle I is used as a safeguard, and to assist to regulate the power of the levers. In fig. 1, the plug A is shown fixed in the stone K, ready to draw it out of the ground, by means of the lifting tackle.

N. B. The hinder legs of the quadrangle are made to close in between the fore legs, for the convenience of carriage.

The following Communication was received from MR. GILBERT GILPIN, *Old Park Iron Works, near Shifnal, relative to his Machine for raising Coals, described in page 74 of the 25th Volume of Transactions.*

SIR,

I AM sorry to see in the 25th volume of the Transactions of the Society of Arts, &c. that the engraver has in the plate put the wrong side of the machine for raising coal and ore to face the pit. Upon that plan the engine house would be between the machine and pit, and direct in the way of the chain. The cranks should face the opposite way.

There

There is also an error of the press, page 78, in describing the size of the cross section of the tire, which renders a confusion in the 11th, 12th and 13th lines. It ought to run thus, beginning at line 8:

"The wrought iron tire is of two kinds, the one for "conical, and the other for cylindrical barrels; the cross "section of the former is nearly a parallelogram*, out of "the upper part of which about one fourth of an ellipsis is "taken, to form a horizontal bearing for those links of "the chain which lie flat upon the tire; the cross section "of the latter is a rectangle†."

I mentioned that I wished the manuscript which I first sent, to be superseded by that which I sent afterwards, but the following passages in pages 78 and 79, I find to be printed from the former, viz.

"It is probable, therefore, that in this manner of work- "ing, chains will last at least fifteen years, but to be cer- "tain we will take it at twelve in the subjoined compara- "tive statements, which show that the expense of chains "as cordage is only about a twenty-fourth part of that of "hempen ropes."

The comparative statement is printed from the last manuscript, (which was varied from the first one, to do away some objections of ropemakers, in regard to durability of ropes,) by which it appears, the expense of chains, as cordage, is only about a fourteenth part of that of ropes. I am pretty certain they will not be even one twenty-fourth of the expense; but it is necessary to correct the error which has arisen in the statements, from combining parts of each of the letters.

* One inch and a quarter, by 5-8ths of an inch.

† One inch and a quarter, by half an inch.

I purpose

I purpose to transmit to the Society a description of an improved machine, which is likely to be of much importance on board men of war and Indiamen.

I am, Sir,

Your obliged humble Servant,

GILBERT GILPIN.

Old Park Iron Works,
July 6, 1808.

To C. Taylor, M. D. Sec.

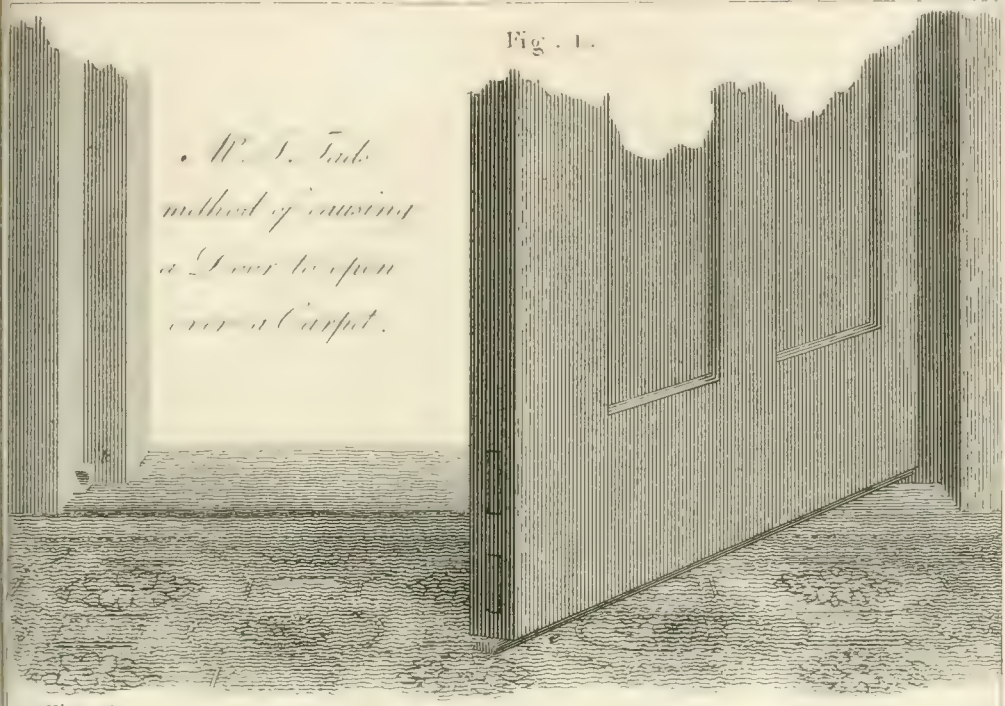
Five Guineas *were this Session voted to Mr.* John Tad, *of Little Hermitage, Wapping, for a Method of Preventing Doors from Dragging on Carpets. The following Communication was received from him, an explanatory Engraving is annexed, and a Model, showing this Invention, is preserved in the Society's Repository.*

SIR,

I have taken the liberty of laying before the Society a model of my invention to prevent doors from dragging on carpets, and to keep out the current of cold air, which enters under such doors as are not close to the carpets underneath them.

I can affix this machinery to the bottom of any door, so that the door shall pass over the carpet with ease, and, when shut, be air tight. It obviates the necessity of screw rising hinges,

Fig. 1.



. W. 1. Tab. method of causing a Door to open over a Carpet.

Fig. 2.

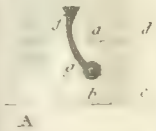


Fig. 3.

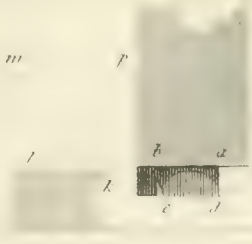
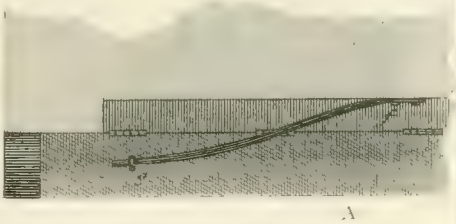


Fig. 4.



. W. 2. Best construction of the joint.

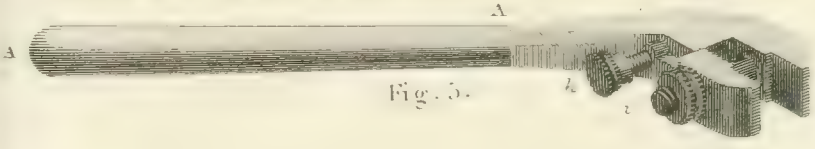


Fig. 5.

Section

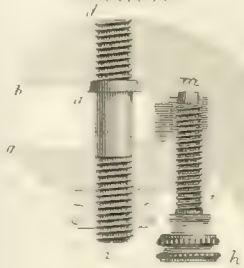


Fig. 6.

Enlarged view of the head

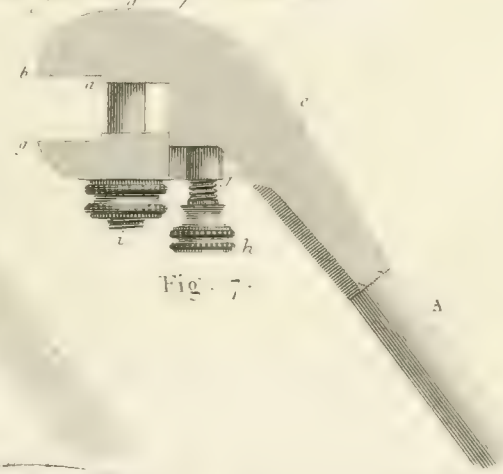


Fig. 7.

TORONTO ATHENÆUM

hinges, and is less expensive than other inventions for the same purpose.

The machinery is constructed of a slip of well seasoned beech wood, equal in length to the width of the door; this slip is one and a quarter inch wide, and half an inch thick, and to be covered with green cloth on the inside; it is to be hung to the bottom of the door with three small brass hinges, and is drawn up by a concealed spring as the door opens, and is forced down when the door shuts, by one end of it, which is semicircular, pressing upon a concave semicircular piece of hard beech wood, fastened at the bottom of the door case, and which holds it down close to the floor or carpet, so as to exclude the air from entering under it. Hoping this invention will meet with the approbation of the Society, I remain, with respect,

Sir,

Your most humble Servant,

JOHN TAD.

No. 4, Little Hermitage Street, Wapping,
Nov. 24, 1807.

To C. Taylor, M. D. Sec.

A Certificate was received from Mr. William French, No. 280, Wapping, stating, that John Tad had fixed to two of his room doors the invention above mentioned, and that he found it to answer to his satisfaction, both in permitting the doors to pass clear of the carpets, and in keeping out the air.

Refer-

Reference to MR. TAD'S *Method of preventing Doors from Dragging on Carpets. See Pl. VII. Figs.* 1, 2, 3, *and* 4.

MR. TAD'S invention consists in first cutting away the bottom of the door, so that it is about one inch and a quarter above the floor; this allows a sufficiency of room for the door to open over any carpet; to close the opening which would now be left under the door when shut, he proposes to fix beneath the door, by means of hinges, a slip of wood, of which *a b d e*, figs. 2 and 3, Plate VII. is a section. Fig. 1 is a perspective view of the bottom of a door, with the invention annexed to it; fig. 2 is a section across the door when closed; fig. 3 is a view of the edge of the door when open; and fig. 4 is a section supposed to be made by cutting the door in two parts, edgeways. The hinges, on which the slip turns, are fixed to the edge. In figs. 2 and 3, from *a* to *b*, is exactly one inch and a quarter, so that when the ruler is turned down upon the hinges, it reaches the floor A A as in fig. 2; in the other direction *a d* it is much less, being only half an inch, so that when it is turned up under the door, as in fig. 3, it leaves three quarters of an inch clear of the floor. It now remains to show how the ruler is turned up or down; it has always a tendency to rise up into the state of fig. 3, by the action of a steel wire spring, shown in figs. 2 and 4, which is concealed in a rebate cut in the bottom of the door; one end of the wire is screwed fast to the door at *f*, the other is inserted into an eye fastened into the slip at *g*, to throw it down into the position of figs. 2 and 4. The end *h*, fig. 4, of the slip farthest from the hinges of the door, is cut into a semicircle, as seen in fig. 3. When the door is just closed, this semicircle is received into a fixed concave semicircle *k*, fig. 3, cut in the end of a piece of wood *k l*, made fast

fast to the door case; the line *m l*, fig. 3, represents the plane of the door when shut, and *p p* part of the door seen edgeways; as the door in shutting moves from *p* to *m*, the semicircular end of the slip *a b d e* presses against the end of the piece *k l*, and as the door proceeds, it turns down as in fig. 2, so that by the time the door is shut, the slip is turned quite down; the edge *e b* of the slip is cut into a segment of a circle struck from the hinges on which it turns. The perspective view in fig. 1 shows that this contrivance, applied to any door, will not offend the eye, as it can scarcely be distinguished from an ordinary door. *K*, fig. 1, shows the concave semicircle of the piece of wood fastened to the door-case, in which the semicircular end of the slip *e* is to be received.

FIVE GUINEAS *were this Session voted to Mr.* WILLIAM BARLOW, *of his Majesty's Dock Yard, at Portsmouth, for an Improved Screw Wrench to fit different sized Nuts or Heads of Screws. The following Communications were received from him, an explanatory Engraving is annexed, and the Instrument is preserved in the Society's Repository.*

DEAR SIR,

I SEND you a screw wrench, from the inventor, WILLIAM BARLOW, with his observations upon it. I have employed him as a foreman during the erection of the block machinery in his Majesty's Dock Yard, at Portsmouth.

If this very useful instrument should meet with the approbation of the Society of Arts, &c. I shall beg leave to recommend

recommend the inventor to their notice, as an intelligent and ingenious person, who is deserving of their encouragement.

I am, dear Sir,

Your obedient humble Servant,

M. J. BRUNEL.

No. 21, Cheyne Walk, Chelsea,
March 7, 1808.

To C. Taylor, M. D. Sec.

SIR,

Permit me to make a few observations on a shifting screw wrench of my invention, which I beg leave to lay before the Society of Arts, &c. through the hands of Mr. Brunel, inventor of the block machinery here.

I have found, from long experience, the imperfections of the various wrenches in common use, for the screw heads and nuts of engines in general, which are often materially injured for want of an instrument which would fit variety of sizes, and be applied with as much advantage as a solid wrench. I have had it in view to unite steadiness with conveniency in making such an instrument, and flattering myself that I have obtained both, I am desirous to communicate my invention to the Society, and have therefore sent an instrument on the principle I have actually used, and which has met with the approbation of my employers and other persons.

This wrench, by means of a nut and screw, is adjusted with the greatest ease to the exact size required, and in that state rendered so steady that in use it is found equal to a solid wrench.

I have,

I have, for several years, been intrusted with the care and repairs of many valuable engines of various descriptions, composing the block machinery in this dock-yard, and I have always considered it as an object of great importance, for the preservation and neat appearance of engines, to attend to all the means which would obtain these advantages, and such, I think, will arise from the use of my universal wrench.

It is, perhaps, unnecessary to point out, that a wrench on this principle, may be varied in its form and size so as to be rendered probably more convenient for some particular purposes for which such instruments are required.

I am, Sir,

Your obedient Servant,

WM. BARLOW.

Portsmouth Dock Yard,
March 1, 1808.

To C. TAYLOR, M. D. SEC.

Reference to the Engraving of Mr. BARLOW'S *Improved Wrench. See Plate VII. Figs.* 5, 6, *and* 7.

This instrument is represented in Pl. VII. Fig. 5 is a perspective view of it; fig. 6 a section of its head; and fig. 7 an external representation of the head. The screw head or nut to be turned is held between two jaws, one of which *a b d e* is forged in the same piece with the handle A A, the other, *f g*, is moveable between two chukes, and fastened to the fixed jaw by the strong screw *i*, which is fixed to the same jaw, passes through the moveable one, as shown in the section fig. 6, and has a nut screwed upon it; the

other screw *h*, is tapped through the moveable jaw, and its point presses upon the bottom of a cavity made in the fixed jaw shown at *m* in the section fig. 6. To make the wrench fit any particular screw head or nut, the nut upon the strong screw *i* must first be loosened, and the screw *h* screwed in or out of the moveable jaw, until the opening *b g* is just the proper width to receive the screw head or nut to be turned by the wrench; the nut of the screw *i* is then to be screwed down, until it presses upon the jaw, and holds it perfectly tight.

The THANKS *of the Society were this Session voted to* MR. SAMUEL CLEGG, *of Manchester, for his Apparatus for making Carbonated Hydrogen Gas from Pit Coal, and Lighting Factories therewith. The following Accounts were received from him, an explanatory Engraving is annexed, and Drawings are preserved in the Society's Repository. A* SILVER MEDAL *has since been voted to him for the Communication.*

DEAR SIR,

WHEN your son was in Manchester, he called to see my nephew's, SAMUEL CLEGG's, improved gas lights, and was desirous to have a plan of his method, which my nephew promised to him, and I undertook to get it conveyed to you. I have, accordingly, taken the opportunity of sending to the Society of Arts, &c. a plan and explanation of his apparatus.

He lighted a large factory in Yorkshire some years ago upon this principle, and has since lighted some buildings in

in this neighbourhood, and I believe he is the first person who succeeded in rendering these lights free from the offensive smell which generally accompanies them. My nephew served an apprenticeship to Messrs. Boulton and Watt, of Birmingham, in the steam-engine business, in which he is now engaged here on his own account, and has made considerable improvements in their construction.

I remain, dear Sir,
Your most obedient Servant,
ASHWORTH CLEGG.

Manchester, May 18, 1808.

To C. Taylor, M. D. Sec.

SIR,

Your esteemed favour I have received, and, according to your request, have sent you a fuller explanation of the gazometer and lamp, accompanied with further drawings.

A gazometer, containing seven hundred cubical feet of gas, weighs about twenty hundred weight, and costs about two pounds ten shillings the hundred weight.

The whole of an apparatus complete, capable of supporting forty lamps for four hours, each lamp affording light equal to ten candles of eight in the pound, will cost about two hundred and fifty pounds. Each lamp consumes six cubical feet of gas per hour. I am happy to find that the Society have honoured my communications with their attention, and I remain, with great respect,

Sir,
Your most obedient Servant,
S. CLEGG.

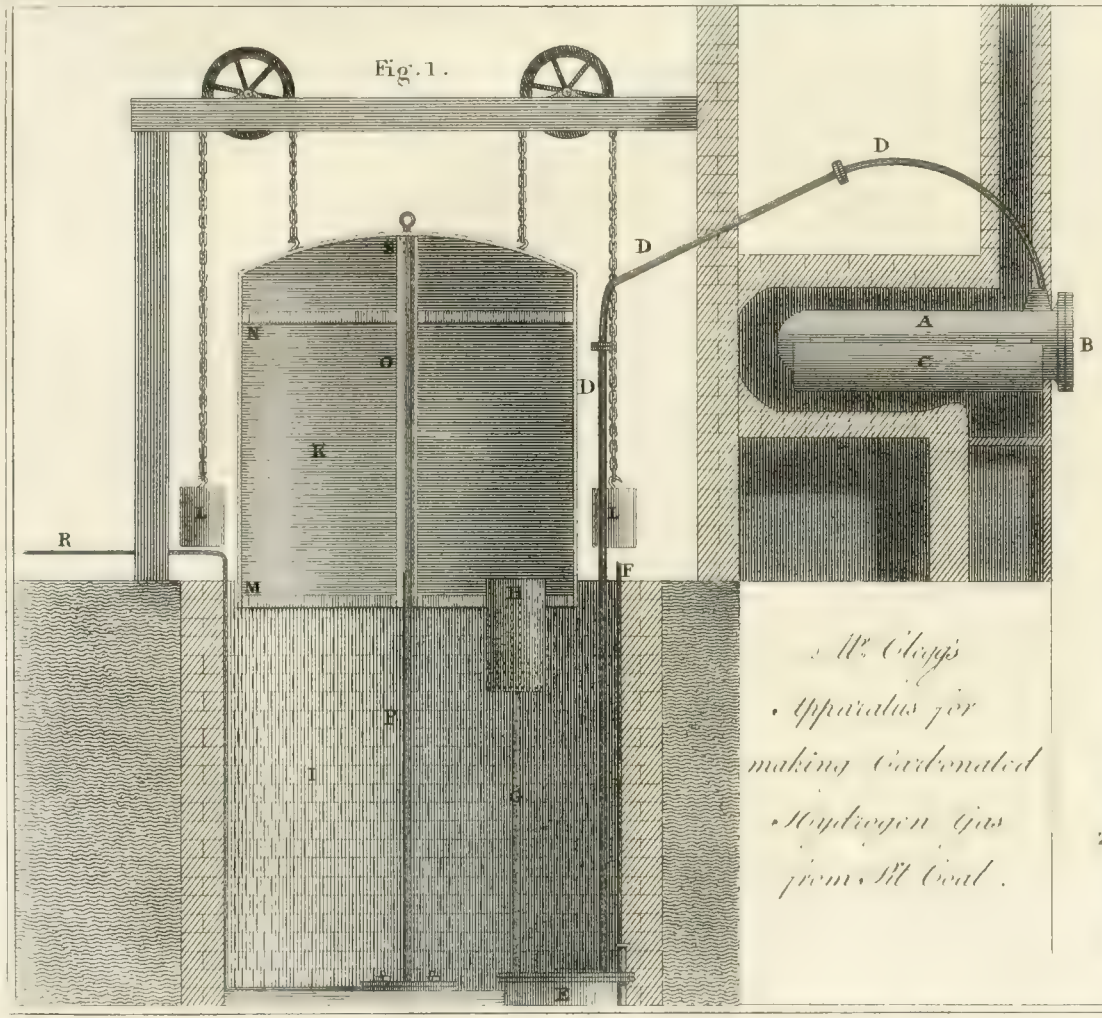
Manchester, Aug. 12, 1808.

To C. Taylor, M. D. Sec.

Reference to Mr. S. CLEGG's *improved Apparatus for extracting Carbonated Hydrogen Gas from Pit Coal. See Plate VIII. Figs.* 1, 2, 3, 4, 5, *and* 6.

In fig. 1, *A* shows the cast iron retort, into which are put the coals intended to be decomposed by means of a fire underneath it, the heat of which surrounds every part of it, excepting the mouth or part by which the coals are introduced. The lid or iron plate *B*, which covers the mouth of the retort, is ground on air tight, and fastened by means of a screw in the centre; *C* is a shield or saddle of cast iron, to preserve the retort from being injured by the intensity of the fire underneath it, and to cause it to be heated more uniformly. *D D D* represents the cast iron pipe which conveys all the volatile products of the coal to the refrigiratory of cast iron *E*, in which the tar, &c. extracted from the coal is deposited, and from whence they can be pumped out by means of the copper pipe *F*. *G* is the pipe which conveys the gas to the top of the cylindrical vessel or receiver *H*; this receiver is air tight at the top, and consequently the gas displaces the water in the vessel *H*, to a level with the small holes, where the gas is suffered to escape and rise through the water of the well *I*, into the large gazometer *K*. The use of the vessel *H* is pointed out as follows, viz. If the pipe *G* reached all through the water, without passing into the vessel *H*, the gas would not be rendered pure or washed; and if part of the pipe did not rise above the water, the water would have free communication with the tar, besides exposing the retort *A* to a very great pressure, so as to endanger its bursting when red hot. This vessel or receiver *H*, in a large apparatus, is about eighteen inches diameter, and two feet long; the quantity of gas, therefore, which it contains, is sufficient to fill the pipes

Fig. 1.



Mr. Clapp's Apparatus for making Carbonated Hydrogen Gas from Pit Coal.

Horizontal Section of the Gazometer at the bottom part.

Fig. 2.

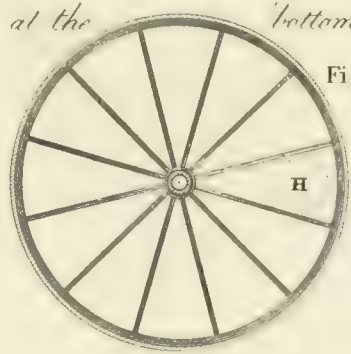


Fig. 4.

Fig. 5.

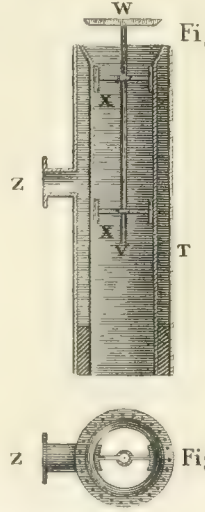


Fig. 6.

Fig. 3.

INSTITUTE

pipes and retort when cool, and prevents the pipe *G* from acting as a syphon, and exposes the gas to the water without endangering the retort.

When the operation begins, the upper part of the cylindrical gazometer *K*, fig. 1, made of wrought iron plates, is sunk down nearly to a level with the top of the circular well *I*, and is consequently nearly filled with water, but it rises gradually as the gas enters it and displaces the water; the two weights *L L* suspended over pullies by chains keep it steady and prevent its turning round, otherwise the lower stays *M* of the gazometer would come into contact with the vessel *H*. There are two sets of these stays, one shown at *M*, and the other at *N*.

There is also an iron pipe *O* made fast in the centre of the gazometer, by means of the stays which slides over the upright pipe *P*, by which contrivance the gazometer is kept firm and steady, when out of the well; it likewise prevents the gas from getting into the cast iron pipe *P*, and the copper pipe *R*, any where but through small holes made in the pipe *O* at *S* at the top of the gazometer, where the gas is perfectly transparent and fit for use.

The pure gas enters the tube *O* at the small holes made in its top at *S*, and passes on through the tubes *P* and *R* to the lamps, where it is consumed and burnt.

The seams of the gazometer are luted to make them air tight, and the whole well painted inside and out, to preserve it from rust.

Fig. 2 shows an horizontal section of the lower hoop of the gazometer *K* at the part *M*, with its stays or arms, and the manner in which the iron pipe *C*, before described at fig. 1, sliding on the tube *P*, passes through the ring in the centre of the hoop; an horizontal section of the receiver *H* appears therein.

Fig. 5 shows a section of one of the gas lamps; the space between the outer tube *T* and the inner tube *V*, is to be filled with gas supplied by the pipe *R*, shown in fig. 1, where a stop cock is inserted for adjusting the flame, which gas passes through a number of small holes made in the outer edge of a circular plate shown at fig. 6, which unites the tubes *T* and *V* at their tops. *V* is the inner tube which conveys the atmospheric air into the centre of the flame; the upper part of this tube is made conical, or widening outwards, to join a circular plate with holes in it, a horizontal view of which is shown at fig. 6. *W* is a button, which can be placed at a small distance above the mouth of the lamp, and its use is to convey, in an expanded manner, all the air which rises through this tube to the inner surface of the flame, which assists the combustion very much; this button may be set at any convenient distance above the tubes of the lamp, as it slides in the cross bars *XX*, by which it is supported in the inner tube.

A current of air also passes between the glass tube or chimney and the outer tube *T*, through holes made in the bottom of the glass-holder, as in Argand's lamps; this surrounds the flame, and completes its combustion, as explained by the view, fig. 3, and section, fig. 4, which have a glass upon each. *ZZZZ*, figs. 3, 4, 5, and 6, show the tube through which the lamp is supplied with gas from the pipe *R*, fig. 1.

TEN GUINEAS *were this Session presented to Mr.* HENRY WARD, *of Blandford, in Dorsetshire, for a Crank useful in working Telegraphs. The following Communications were received from him, an Engraving is annexed, and a complete Model is preserved in the Society's Repository.*

SIR,

BEING one day at the telegraph on the Blandford station, I observed a great inconvenience to attend the working of it in windy weather, and many errors occasioned in consequence. I have since made a model of a crank, which will perfectly remedy these defects, and have herewith sent the model for the inspection of the Society, trusting it will meet their approbation.

I am, Sir,

Your most obedient Servant,

H. WARD.

Blandford, April 20, 1807.

To C. TAYLOR, M.D. SEC.

Reference to the Engraving of Mr. HENRY WARD's *Crank for Telegraphs See Pl. IX. Figs.* 1 *and* 2.

A front view of this is shown in fig. 1, and a side view in fig. 2. The signal board *a a a a* of the telegraph is of the usual kind, the improvement consists in the crank for moving and retaining it. The spindle the board *a a* turns

upon, has a small wheel *b b* upon it, to which two segments *d d*, &c. are attached by means of a piece of steel spring fixed at *e*, which always causes the segments to recede from the wheel; the segments have grooves in their peripheries to contain two cords *f* and *g*, by which the signal board *a a* is moved; each segment has a notch in it at *h* and *i*, which notches are a quarter of a circle from each other; *k* is a piece of iron projecting from the frame of the machine, when the signal board is set upright, as in the figures; the notch at *h* receives the piece of iron *k*, and as the segment is pressed towards it by the spring at *e*, by which the segment is fastened to the wheel, it is plain that the force of the wind acting upon the board cannot turn it, as it is locked fast; but when the operator pulls the cord *f*, it draws the segment *d* close to the wheel *b*, this unlocks the wheel, and the signal board is at liberty to be moved by the cord *f* edgeways, when the notch at *i* in the other segment *e* receives the piece of iron *k*, and holds it until again moved to its original position, by means of the cord *g*, which acts in the same manner as *f*.

Remarks on his Compensation Pendulum.

SIR,

In looking over the description of my pendulum, described in the twenty-fifth volume of the Society's Transactions, I perceive there is an error committed, which, if not corrected, will greatly perplex the reader. In page 118, line 1 and 2, it stands thus: "This screw turns in the rod *h h*, passes through the zinc rod *k k*, and screws into the iron rod *i i*." Now the fact is, that the screw does not enter

enter the iron rod *i i* at all, but goes no further than barely through the zinc rod. It ought, therefore, to read thus: "This screw is tapped into the rod *h h*, but that part of it "which enters the zinc rod *k k* has the threads turned off, "and passes barely through that rod."

I am, Sir,

Your very obedient Servant,

HENRY WARD.

Blandford, August 3, 1803.

To C. Taylor, M. D. Sec.

The Gold Medal *of the Society was this Session voted to Captain* George William Manby, *of Yarmouth, Norfolk, for a Method of preserving the Lives of shipwrecked Persons, and forming a Communication with Ships stranded, by means of a Rope thrown over the Vessel from a Mortar on Shore. The following Accounts were received from him, two explanatory Engravings are annexed, and Models are preserved in the Society's Repository.*

SIR,

When I was last in town, I had the pleasure of meeting you, and saying it was my intention of submitting to the Society of Arts, &c. my invention of saving people from a vessel stranded on a lee shore. I have had the pleasure of putting it in practice with a success beyond what my

my expectation led me to hope, and I shall take the liberty of sending you the papers in a few days.

I am, Sir,

Your most obedient

Very humble Servant,

GEO. W. MANBY.

Yarmouth, Norfolk, March 4, 1808.

To C. Taylor, M. D. Sec.

SIR,

I request you will do me the honour to lay before the Society for the Encouragement of Arts, Manufactures, and Commerce, the various papers herewith transmitted, respecting my invention for throwing a rope a given distance to a ship stranded on a lee shore, whereby an apparatus can be used to rescue the crew, &c. The idea was suggested from the numerous melancholy events of shipwreck that have happened on this part of the coast, within a short distance of the shore; these determined me to make it a favourite pursuit, and I resolved to persevere in it, until some happy mode succeeded effectually to give assistance on similar occasions. From the distressing day when his Majesty's gun brig, Snipe, came on shore within fifty yards of the beach, when no communication could be procured, I have been making innumerable experiments, but unable to carry them to the extent wished, until the Right Honourable Board of Ordnance did me the honour, on my application to them, to supply such a piece of ordnance, stores, and apparatus, as appeared best calculated to complete my views. They have likewise further complied with my

my request, and the dangerous stations of Cromer, Happisbro', Winterton, Lowestoffe, and Orfordness, are to be immediately supplied.

The service can be performed in a quarter of an hour from the time of the mortar coming opposite the vessel in distress, when the persons are initiated in the several uses. Models explanatory of its performance I request you will do me the honour to place, for the use of the public, in the Repository belonging to the Society; and as a painting of the subject will convey a clearer idea of the service, and extent of the invention, than it is possible for me to describe, I have directed one to be brought for the inspection of the Committee.

I have the honour to be, Sir,

Your most obedient,

Very humble Servant,

GEO. WM. MANBY,

Captain, B. M. Yarmouth.

Yarmouth, Norfolk, March 28, 1809.

To C. TAYLOR, M. D. SEC.

DEAR SIR,

I HAVE the honour, as Secretary to the Suffolk Humane Society, as well as by the desire of many other persons who attended your experiments at Lowestoffe on the 26th of August, and the 10th of September, to transmit to you their unanimous vote of thanks. I have also added some minutes which I took at the time of those experiments. It gives me peculiar pleasure to find, that those for whose benefit the experiments were principally undertaken, namely, sailors, are fully convinced of the advantage of the plan

plan you have adopted for securing a communication between the shore and a stranded vessel.

I remain, Sir,

Your obedient humble Servant,

M. MAURICE,

Secretary of the Suffolk Humane Society.

Normanstone, Sept. 21, 1807.

To CAPTAIN MANBY, Yarmouth.

Minutes respecting the Suffolk Humane Society at Lowestoffe.

August 26, and September 10, 1807.

Rev. I. G. SPURGEON, V. President, } in the Chair.
Rev. BENCE BENCE, Treasurer. }

ON both occasions, it was unanimously resolved;

1st. That in the opinion of the Suffolk Humane Society, as well as of that of many other gentlemen present, that Captain Manby's experiments for effecting a communication between the shore and a stranded vessel, made by throwing a shot with a rope, appended to it over the vessel, if she be near land; or by a grapnel thrown from a mortar, by which a boat can be hauled over the surf, have completely answered the purpose for which they have been attempted.

2dly. That the Thanks of the meetings be given to Captain Manby, for the zeal and exertions he has shown to promote the object, for which the Suffolk Humane Society was instituted.

3dly. That these resolutions be published in the county papers, signed by M. Maurice, Secretary.

Minutes

Mr. H. Ward's Crank for a Telegraph.

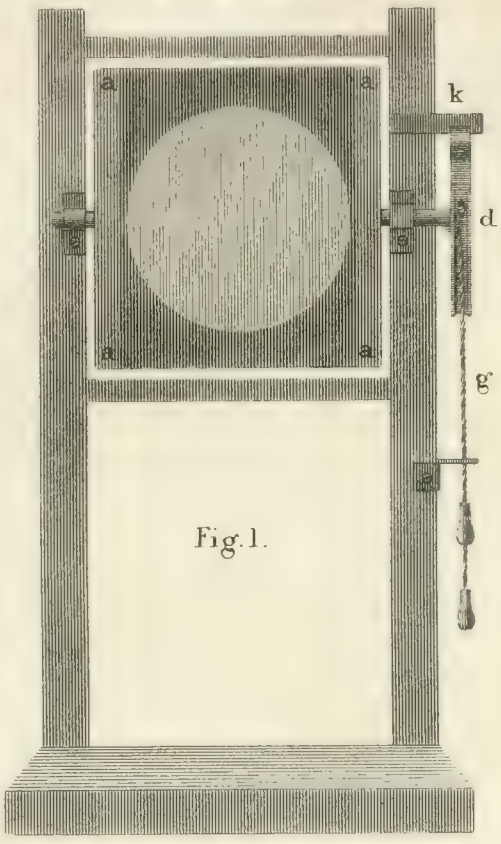


Fig. 1.

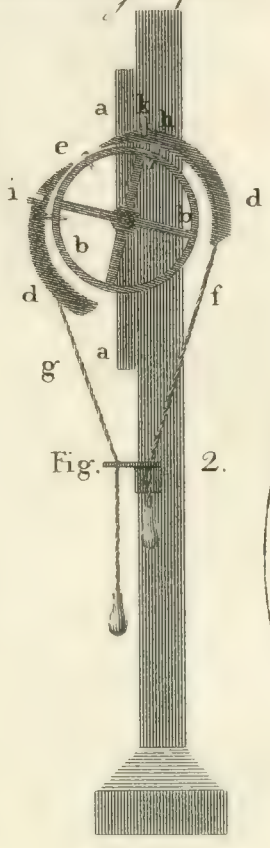


Fig. 2.

ATHENÆUM

Capt. Manby's method of relieving Shipwrecked Seamen.

Fig. 3.

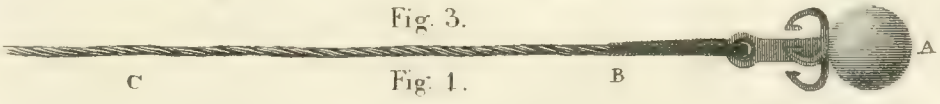
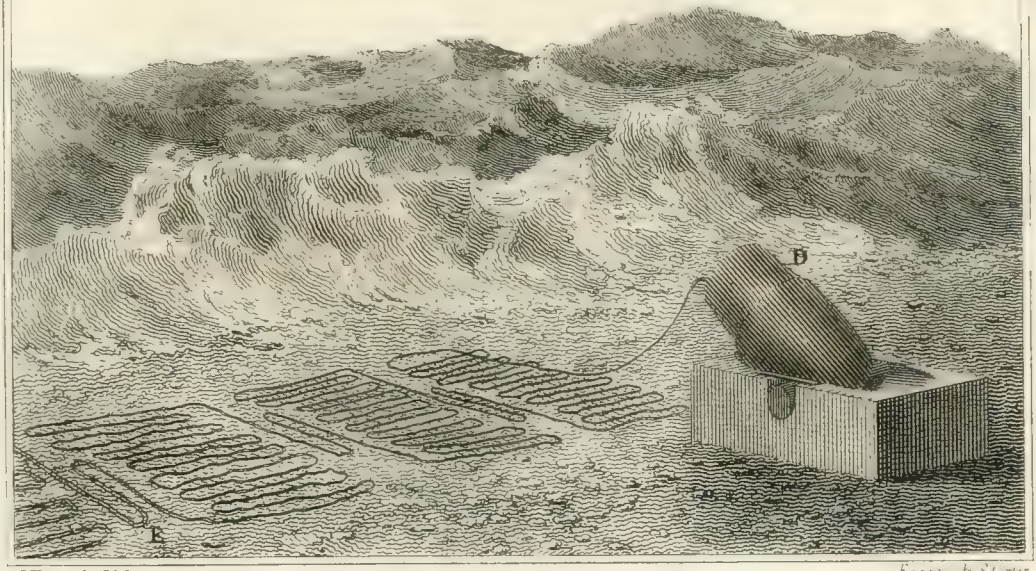


Fig. 4.



J. Farey jun. del.

Engraved by S. Porter

Minutes of Captain MANBY'S *Experiments at Lowestoffe, August 26th and September 10th*, 1807.

A cohorn of four inches and a half bore, weighing three quarters of a hundred weight and one pound, at thirty-five degrees elevation, loaded with four ounces of gunpowder, threw a round shot weighing eleven pounds and a half, to which was fastened a hided rope, and a large deep-sea line, to the distance of one hundred and eighty yards.

At an elevation of thirty degrees to one hundred and eighty eight yards, a field piece of five inches and a half bore, threw a round shot, barbed at the top, weighing thirty pounds, fastened to a whale rope one inch and a half, to the distance of one hundred and ninety yards; the elevation was twenty degrees and a half, and a charge of eight ounces of powder.

The same piece, elevated twenty-five degrees, with a charge of ten ounces of powder, threw a shot similar to the last two hundred yards.

The grapnel with extended flutes, weighing forty-two pounds, and the same rope as before, the piece at an elevation of twenty-two degrees, and a charge of ten ounces of powder, was thrown one hundred and ninety yards. A boat was hauled over the surf, by pulling at the line fastened to the grapnel, which she went to, took up, and returned again to the shore.

M. MAURICE, SEC.

CERTIFICATES.

Norfolk, Great Yarmouth.

JOHN PROUTING, late master of the brigantine or vessel called the Elizabeth of Plymouth, maketh oath and saith, that he was on board the said vessel, when she was unfortunately stranded on the beach of Great Yarmouth aforesaid,

said, in a violent gale of wind, on Friday the 12th day of February instant. That a rope from the shore was thrown by a piece of ordnance to the distance of one hundred and fifty yards, over the said vessel, and lodging upon her rigging, at which time no other communication could be obtained; and by means of which rope so thrown, he solely attributes the safety of himself and crew. That he could not at the time have used a piece of ordnance, or any rope on board for effecting a communication with the shore, from the rolling of his said vessel and the sea making continual breaches over her; and that the deponent is fully convinced that the invention of throwing a rope to a ship or vessel stranded on a lee shore, is of the utmost consequence and importance to a maritime and commercial country, and interesting to the world at large.

JOHN PROUTING.

Sworn at Great Yarmouth aforesaid, this 22nd day of February, 1808, before me,

EDMUND K. LACON,
Mayor of the Borough of Great Yarmouth.

JOHN YARLEY, Midshipman-gang, and JAMES CLERK late Serjeant of the Cambridge Regiment of Militia, stated, that they were present when Captain Manby effected a communication between the shore and the Brig Elizabeth, in the violent storm of the 12th of February 1808, by means of a rope thrown from a mortar over the vessel, by which rope the people from the beach hauled a boat through the surf to the vessel, and brought out the crew, consisting of the master and four men; and they firmly believe, as stated by the said master, John Prouting, that the safety of him and his crew were solely to be attributed to Captain Manby's invention of throwing a rope to their assistance.

Copy

Copy of a Letter from I. B. HUNTINGTON, *Esq. one of his Majesty's Justices of the Peace for the County of Norfolk, to Captain Manby.*

DEAR MANBY,

PERMIT me to congratulate you on your very successful and excellent experiments, made on Winterton Beach, last Wednesday, by your invention, of saving lives in actual shipwrecks, and to express my entire conviction, that hereafter it will be the means of saving many lives. I have lived in this place upwards of twenty years, and in that time witnessed many dreadful scenes. I can, with the greatest truth, affirm, to have known upwards of one hundred persons to have perished, the greater part of whom might have been saved, had your truly ingenious invention been on the spot. It gave me great pleasure to see the praiseworthy and active part the men on the beach that day evinced, and from whose future exertions much good is to be anticipated.

It has been mentioned to me, that your invention had been before tried, and a premium for the same given by the Society for the Encouragement of Arts, in consequence of which I looked into the records of that Society, and find that in 1791, experiments were made at Woolwich, by Lieutenant Bell, of the Royal Artillery, to throw a rope from a mortar placed in a boat on the river, by which he hauled himself and another person to the shore, on a raft, floated by four casks. I can by no means think this bears any analogy to yours, as every one at all acquainted with the state of a vessel shipwrecked, and the boisterous sea and wind usually attendant, must know the impossibility of such a method being by any means practicable.

The invention of your barbed shot will very often be of the greatest benefit, when, from the severity of the weather, the

the seamen are rendered incapable of assisting themselves, as your boat, which is, in my opinion, the best I have seen, may be then hauled from the beach. Although your grapnel is not yet brought to perfection, still, from your persevering disposition, I flatter myself that useful part of your apparatus will not be long wanted. As no one knows the necessity of this mode of saving lives more than myself, I most earnestly hope the same will meet with encouragement from the public, and that you may receive the due reward of your merit, is the wish of

Dear Sir, yours truly,

I. B. HUNTINGTON.

Somerton, March 5, 1808.

To G. W. MANBY, Esq.

Minutes of Experiments made by Captain MANBY *at Winterton, March 2, 1808, certified by* I. B. HUNTINGTON, *Esq. one of his Majesty's Justices of the Peace for the County of Norfolk.*

A galloper carriage conveyed from Yarmouth to Winterton the following stores, viz.

One five and a half inch royal mortar on its bed; two ammunition boxes filled; two hundred fathom of one inch and a half rope; two hundred fathom of deep-sea line; twenty fathom of one and a half inch rope, fitted up with two blocks, as a gun-tackle purchase; three iron shod stakes; a large maul to drive them with; a cot fitted up on a stretcher, with gudgeons and fore-lock pins, to convey people on shore; two round twenty-four pounder's shot, with eyes, to form communication; one shot with barbed short flukes to catch the rigging of a vessel, for the purpose of hauling a boat off, when the crew are so benumbed with

with cold or fatigue, that they are incapable of assisting in the plan intended for their relief; one grapnel forty-two pounds weight, to haul a boat over a high surf to get off to ships in distress at a distance from the shore.

The carriage thus loaded travelled with considerable ease, accompanied by two men seated on the ropes, and was found capable of going with two horses at the rate of eight miles an hour. The mortar being laid at the angle of twenty-two degrees and a half (which was found to give the greatest range with a rope if projected against the wind,) threw a deep-sea line with

4 ounces of powder 140 yards
6 ..... do.... 182
8 ..... do.... 215
10 ..... do.... 249
12 ..... do.... 290
14 ..... do.... 310
16 ..... do.... 322

The barbed shot at the same angle, with sixteen ounces of powder, carried two hundred and forty-six yards of one inch and a half rope.

The grapnel, with the same rope as the last, with sixteen ounces of powder, was blown to pieces, but the same grapnel had been thrown at Lowestoffe, on the 10th of September preceding, one hundred and ninety yards, with ten ounces of powder, and was found to answer every purpose of its invention.

I do certify the above was made in my presence,

I. B. HUNTINGTON.

DEAR SIR,

I BEG leave to express my pleasure and great gratification, from the experiments which you did me the favour to make

yesterday, at Caistor, in my presence, and in the presence of the principal inhabitants of that parish, most of whom have from their infancy resided there, and have been eye witnesses of many sad scenes of shipwreck, which have occurred on their beach, and all of whom (I believe) expressed their thorough conviction, that had the experiments tried yesterday, been within their reach on those agonizing occasions, they might now exult in the glorious reflection of having rescued numbers of their fellow-creatures from an untimely and watery grave. This seemed to be the universal and concurrent opinion of all present yesterday. For my own part, having lived more than thirty years upon the sea coast, I feel no hesitation to add mine to the many respectable testimonies in your possession of the efficacy of your invention, and that by affording a certain and safe communication between the shore and the distressed vessel, you have provided the means of escape to numbers of forlorn, and otherwise lost mariners, even where a life-boat should not be able to reach the vessel's side. But I firmly believe that hardly in any case *this* will be prevented; for I am persuaded that the round shot with barbed points, having been thrown over the ship, and drawn back by the people on shore, (even if the wretched sufferers were so enfeebled or benumbed as to render no assistance,) would lay such hold on the sides, or rigging, as would enable the men in the life-boat to keep the boat's head at right angles with the opposing wave; and that they would, in spite of the most outrageous surf, reach the vessel. This (I am almost confident) might, and would be effected, and for the accomplishment of it, your country, Sir, is your debtor. In short, whether the invention originated with you or not, certain it is, that through *your* means it is become *practicable*, and may be rendered subservient to the noblest purposes,

poses, that of saving the lives of our fellow creatures; and, in particular, of many of that ever to be respected body of men, the British seamen.

I am sure, Sir, that the labour and attention which you have bestowed on this highly important subject, will ever afford you the most heartfelt satisfaction; but, Sir, it is entitled to something more, it is entitled to your country's gratitude, which gratitude I most sincerely wish may be expressed by an ample remuneration.

That you may long experience the benefits of your praiseworthy exertions *externally*, as I am sure you must from self-complacency *internally*, is the sincere wish of,

Dear Sir,

Your obliged and obedient Friend and Well-wisher,

B. W. SALMON,

Rector of Caistor, and one of his Majesty's Justices of Peace for the County of Norfolk.

Ormesby, March 8, 1808.

To G. W. MANBY, Esq.

SIR,

I HAVE witnessed your experiments at Winterton, and having been bred to the sea, twice shipwrecked on the neighbouring shore, and fourteen years resident on the east coast of Norfolk, I know the value of such a communication in distress or shipwreck. Not a winter has passed during the time above mentioned, without several wrecks having been driven on shore, and the greatest part of their crews having perished, for want of relief or aid from the shore. I assure you, that if your experiment had been practiced on February 18, 1807, several lives would certainly have been saved on this coast. I was one of the spectators

on the beach at Hasbro', when the Hunter cutter was lost, and although she was within 150 yards of the cliff, no assistance could be given her;—likewise the Abcona of Sunderland. It is in fact too tedious to mention the different ships which I have witnessed being wrecked within the fourteen years I have resided on the coast, and all the hands lost.

The misfortune of this coast is, that when the wind blows strong to the northward, the sea runs up to the cliff, which makes it impossible to get a boat off, or one to come ashore with any person, excepting at some particular places.

I am, Sir,

Your most obedient Servant,

FRANCIS WHEATLEY.

Mundsley, March 14, 1808.

To CAPTAIN MANBY.

SIR,

YOUR having done me the honour to request particularly that I would be present at your experiments, I have made it a point to be so, and have seen with great pleasure, the ardent zeal with which you prosecute the perfection of your excellent apparatus, for the relief of shipwrecked seamen.

That it is extremely difficult, (and in many cases absolutely impossible,) to get a communication with a vessel, I have seen many instances of, especially on the beach between Yarmouth and Lowestoffe, parallel to which runs, for about 60 miles in length, a ridge of sand about one hundred and fifty yards from the shore, on which vessels ground, and on which breaks (in a storm) a tremendous surf, the intervening space between the ridge and the shore being full of a very cross and heavy sea, which forms an eddy, something of the nature of a whirlpool, that baffles every endeavour of the people on board, or on shore, to get communication

munication with each other; a cask, for instance, or any other floating substance, instead of drawing on shore, turns round, and continues mid-way, and with the wind at, or near north, or south, never comes on shore at all; and I have seen two hours employed in the attempt, which in winter, when the people are perishing fast, owing to their being wet and frozen, is particularly distressing; but in many cases it is absolutely impossible for the men to be on deck, (especially in small coal-laden vessels,) the sea breaking completely over them, as high as their leading blocks, consequently the people are obliged to be in the rigging, and then it is quite out of their power to assist themselves, nor is it possible for the people on shore to give them any, except with the assistance of your excellent apparatus, which I do consider a most effectual relief in such cases of distress.

It has been asserted by some people, that the best method would be, instead of having the apparatus on shore at different stations, to have one on board every ship, so that the shot might be thrown on the beach or rocks, which it is considered would answer best: who made the assertion I cannot tell, but I cannot think it possible to succeed, as will appear when it is considered that in many cases of shipwreck, (especially when the vessel is deep laden,) the men, as I have observed before, are totally unable to keep the deck, the sea completely breaking over it, consequently they are obliged to take to the rigging, where they are soon benumbed by the extreme cold, and quite unable to assist themselves, while those on shore, who are dry, and who have room with exercise to keep their blood in circulation, are the reverse; besides, it takes up a considerable space (more than there is on board small vessels, supposing the men are capable of exerting themselves,) to manage the

apparatus. In short, many more reasons might be stated, which are equally strong, but I think it is needless saying any thing further on the subject.

The throwing the grapnel I consider a most important part of the business, as without it I conceive it impossible to get a life-boat off a beach similar to the one I have before mentioned; and, indeed, it has always been found impracticable, and seldom attempted when blowing very hard, and a great surf, as the weight of the boat is so considerable when she is struck by a sea, that it is not in the power of any set of men to pull her through, without the assistance of a rope a-head; now the grapnel being thrown by the force of the powder two hundred yards, falls without the broken water, and enables the men to haul her through it without difficulty; and such a new and effectual power is acquired by the invention, as will be the means of saving many valuable lives: for instance, the efficacy of the grapnel may be conceived by a case I will state,—suppose that a ship is on Caton sand, with a flood tide, and the wind blowing very hard at N. N. E. the life-boat at her station at Lowestoffe is rendered useless, because she is too far to leeward to gain the vessel until perhaps the ebb makes, before the ship would be all to pieces, and every soul on board lost to their country and friends. To obviate such a dreadful calamity, it would be proper to put the life-boat into a carriage made on purpose, and by means of the turnpike road which runs parallel to the shore, she is easily conveyed to any point to windward of the vessel on the sand, so as to be able to gain her; but when she is drawn on the beach ready to be launched, the difficulty of getting her through a tremendous surf of one hundred and fifty yards, is insurmountable, without the assistance of your invention of the grapnel, which enables the men employed

to

to accomplish the task with ease; even supposing the greatest sea possible to be breaking on the beach, the grapnel, together with the life-boat, will save every soul. Now, I do not state this as a case that may happen, but that often (too often indeed) occurs, and really did so to a ship the other day, but there not being either so much wind or sea, as but a very few hours previous to her getting on the sand, the life-boat was able to get off at her station, and by means of horses was towed along the beach to windward of the ship, and passing completely over the body of the sand, without the least danger to any on board her, reached the ship; but had she struck the sand a very short time before she did, the means I have mentioned must have been had recourse to, and the grapnel thrown to haul her off by, as it would have been impossible to have gained the ship any other way, owing to the sea running so very high, that any attempt to get her off at her station would, I have no hesitation in saying, have been quite fruitless.

Before I conclude, I will relate what I was an eye witness of last year, the same morning the Snipe gun brig was on shore, and which I think will prove the great utility of throwing the shot, and endeavouring to get a communication by the means of it.

A large coal-laden brig came on shore on the Gunton beach, a little to the north of the Ness Point, and where it is rather steep, in consequence of which she grounded very near the shore, so that the same sea that struck her broke on the beach, and so very heavy was the surf, that it broke over her as high as her leading blocks, the brig lying broadside to the beach. Being in this dreadful situation, her people were all obliged to take to the rigging for safety, the deck being, by the fury of the sea, completely cleared of every thing; nor was it in our power, although so near

them, to give any assistance to the poor men, (nine of whom were in the lee main rigging, and two in the fore top,) but were obliged to be silent spectators of the dreadful scene. Had we been so fortunate as to have been provided with your excellent apparatus, I am confident, before the dreadful end of the fatal catastrophe, we should have been able to have saved, with ease, every soul on board, but we were not so fortunate; the consequence of which was, that all but one man were lost to their friends and country for ever. The brig, after laying some time in this situation, parted at the bins, her upper works, masts, and men, all falling together with a most dreadful crash to sea-board, and in a moment the nine poor men in the lee main shrouds were lost for ever to our view. The two men in the fore top were in a better situation, for when the masts, &c. fell, the wind being at north (parallel to the shore) canted them round, and in consequence the mast heads swung on the beach, when one of the men getting from the top to the wreck, by swimming, was lost, the sea being too heavy for him. Such is the dreadful tale, which might have ended differently, had we been provided with your excellent apparatus.

I am, Sir,

Your obedient Servant,

JOHN FOWLER.

Corton.

To Captain GEO. MANBY, Yarmouth.

The SOCIETY of ARTS, &c. have received Certificates of approbation of Captain George William Manby's invention, from the following persons, who have witnessed experiments

ments made by him on this plan, and state, that the system is fully adequate to answer the laudable purposes of the inventor:

Edmund K. Lacon, Esq. Mayor of Yarmouth.
Wm. Fisher, Esq. Deputy Mayor.
Wm. Danby Palmer, Merchant.
Thos. Hurry, Merchant.
Wm. Hurry, Merchant.
Timothy Steward, Merchant.
B. Douglas, Vice Admiral of Yarmouth Port.
R. Currey, Captain of his Majesty's ship Rocbuck.
Richard Turner, Clerk, Minister of Yarmouth.
Charles Cobb, Captain, Royal Navy.
Thomas Forrest, Captain, Royal Navy.
Samuel Barker.
Timothy Steward.
James Palmer.
Nathaniel Palmer.
J. Watson.
F. R. Reynolds.
J. Preston.
J. Preston, jun.
Dover Colby.
John Fisher.
Andrew Yetts.
B. Costerton.
Robert Warmington.
M. Maurice, Esq. Lowestoffe, Secretary to the Suffolk Humane Society.
Sir Thomas Blomefield, of the Royal Artillery.
W. Palgrave, Collector of the Customs.
J. B. Huntington, of Somerton.
Thomas Cloves, Esq. of Caistor, Lord of the Manor.

Wm.

Wm. Branford, of Caistor.
Francis Wheatley, of Mundsley.
Richard Wortz.
William Pile.
Samuel George.
John Haylett.
Robert Brown.
Matthew Haylett.

A Certificate from William Taylor, Esq. of his Majesty's Navy Hospital, at Yarmouth, states, that he was present when his Majesty's gun brig Snipe was stranded on Garleston beach, and if Captain Manby's plan had been used, the sixty-seven persons lost would all have been saved, being certain of this from what he saw when the Elizabeth was stranded.

By further Certificates from John Pope, James Easter, and Simon Wilson, it appears, that near two hundred and fifty persons have perished between Yarmouth and Lowestoffe within the last twenty years, the greatest part of whom would have been saved upon Captain Manby's plan.

SIR,

When I had the honour of leaving the models with you, the leather case that effectually prevents the rope from burning, and what I conceive to be the first feature in the invention, was omitted: I therefore inclose one, and request you to draw out the present piece of cord, and pass through it the one now fastened to the small ball, taking care the leather goes once round the eye of the ball, to prevent it from slipping up, and the end made fast in the manner represented

presented by the inclosed. Knowing that the success of the service depends upon the regularity in laying the rope, I have given a plan of the best mode repeated practice has furnished: The fakes should not exceed five or six yards, for if extended to a much greater length, the vibration at each extent (like the pendulum of a clock) becomes so considerable, that a deep-sea line is unable to resist its force, and consequently the object of service is defeated, with the loss of the shot and part of the line. By thus contracting the width of the fakes, will throw the piece of ordnance further from the water's edge, if you wish to have your fakes in one length; to obviate which, and supposing you want to give the greatest possible range, from the stranded vessel being very sharp, or drawing much water, the rope should be laid in different compartments, which I would at all times recommend, particularly should the gale blow on the side, a wind that much oftener brings vessels on shore on this part of the coast, than when blowing dead on the beach; in this case the mortar should be laid behind that compartment most to leeward, to prevent the rope that is running out from getting foul of the next compartment, which would probably be the case if fired from the windward side.

I have the honour to be,

SIR,

Your most obedient humble Servant,

GEO. WM. MANBY.

Barrack Cottage, Yarmouth,
April 5, 1808.

To C. TAYLOR, M. D. SEC.

Refer-

Reference to the Engraving of Captain MANBY'S *Mortar, and Method of laying the Ropes for Communication with Stranded Ships. See Pl. IX. Figs.* 3 *and* 4.

Fig. 3 shows the shot and grapnel; B the leather case which covers the end of the rope, and prevents it from burning C, a part of the rope or deep-sea line.

Fig. 4, D, represents the mortar prepared for firing; E the rope laid in different fakes or compartments, ready to be projected by the shot to which it is attached within the mortar, as fully described in Captain Manby's preceding letter.

Reference to the View of Captain MANBY'S *Methods of forming Communications with Ships Stranded, as shown in the last Plate of the Volume.*

A five and a half inch royal mortar is laid at the object requiring assistance, if the wind blows directly on the shore; but an allowance to be made to windward, in proportion as the wind blows on the side, as the body of rope will fall considerably to leeward in that case. The rope requires the greatest regularity in being laid, as on that depends its preservation; it must be short faked, as shown in Plate IX. fig. 4. and care taken that the fakes do not touch each other; the end is passed through a leather case of three feet in length, which effectually prevents the rope burning, and bent to a large eye that projects out of the shot. It being fired over the vessel, the rope falls on the rigging. When the persons on board get it, they are to return a rope by the one sent, to which the people on shore will bend a stout rope, and a tailed block rove with the

rope

Sartorius pinx.t

W Woolnoth sculp.

Capt.n Manby's Method of forming a Communication with Ships stranded.

rope that had been fired, to get communication; these they will haul on board. The stout rope must then be made fast to any part of the rigging they can depend on; but if the masts are standing, I should recommend that it be fastened to the mast head, just below the cap, for the convenience of getting from the top into the conveyance sent to them, as the people are most likely to assemble in the tops. The other end of the large rope should be tied to a long gun tackle purchase, secured by three iron shod stakes, driven triangularly into the ground. The tackle being bowsed, keeps the rope sufficiently taught, and persons easing off the fall, as the ship rolls, prevent the rope parting, or what it is lashed to, from being carried away. The tailed block is made fast just under the large rope, and one end of the small rope that is rove through it, is bent to the fore part of the cot—the other end to the after-part of the same conveyance. The cot has large eye-let holes in it, to let out water it might catch in dipping through the top of a surf, and lashings to secure the people from being washed out. It is extended by a stretcher of wood, having gudgeons and forelock pins at each end to receive the great rope, and travel on it to and from the vessel, as long as she holds together, for the purpose of bringing on shore the crew, goods, or stores.

In the back scene of the engraving is shown the act of firing a grapnel and rope over a vessel in distress, in order to form a communication with the vessel.

In the fore part is represented the communication formed betwixt a vessel and the shore, with the method of hauling the cot to and from the vessel, by means of an endless rope.

PAPERS

IN

COLONIES AND TRADE.

The SILVER MEDAL *of the Society was this Session voted to* GEORGE ERRINGTON, *Esq. of Yarmouth, for his Improvements in the Cure of White Herrings, after the Manner of the Dutch Pickled Herrings. The following Communications were received from him, and Samples of the Herrings were produced to the Society.*

SIR,

I BEG leave, through you, to make my claim to the Society for the Encouragement of Arts, &c. for the Premium offered by them for Curing White Herrings, equal to those cured by the Dutch, and shall state the experiments I have made for such purpose.

In the year 1804, having imported a cargo of the best Bay, or St. Ube's salt, I engaged some experienced Dutch fishermen, and sent a vessel of fifty-four tons burthen into the North Sea in the month of July. They were successful in their first voyage, and returned within fourteen days with ninety-six barrels of pickled herrings; and making a second trip, they brought sixty barrels more; all of which I sold to Mr. Timothy Hobbs, No. 146, Whitechapel. I then

then sent two boats upon the fishery, but both of them returned in the month of September without success.

Determined to prosecute the herring fishery, and finding that the meshes of our nets were smaller than the Dutch, and our fish not equal in size to theirs, I bought a whole fleet of new Dutch nets, and fitted them out for the use of our fishing vessels, at a great expense, and sent the same vessel as before, with nearly the same crew, early in June, 1805, to fish with the busses off Shetland, and the north coast of Scotland, but my vessel returned, after a six weeks cruize, without any herrings, which the crew attributed to the meshes of their Dutch nets being so large that the fish passed through them. The men refused to fish any more with them, and I have laid these nets aside at a total loss. I sent out the vessel again, having put on board her a fleet of our common nets; she soon returned with a full cargo of about one hundred and twenty-nine barrels of good pickled herrings when repacked, which were all sold to Mr. Hobbs, as before.

In 1806, being discouraged by the want of success at so early a period as June, I did not send my boat out till July. After a cruize of thirty-six days, she brought back a cargo of one hundred and ten barrels of pickled herrings; but there being at that time a vast quantity of Dutch prize herrings brought in, the home market was glutted, and my herrings were sold for the West Indies.

This year, not apprehending such competition from the Dutch fish in our market, I sent out the same vessel, which had always been under the same master, Henry Olley, and with nearly the same crew, now well instructed in the art of gipping, &c. and after a three months' voyage upon the coast of Scotland, from the Firth of Forth to Shetland, she brought home one hundred full repacked barrels, and six-

teen

teen half barrels of pickled herrings, of which Mr. Hobbs had fifty-two barrels and thirteen half barrels, cured like the sample now sent to the Society. The other barrels are adventured to Surinam.

The process of curing the herrings, as declared to me by the master Henry Olley, and which, he affirms, he sees that the crew strictly perform, is as follows: The vessel being well provided with good substantial oak barrels, and especially with good strong coarse bay salt, the crew begin gipping the herrings as soon as taken; this operation is the act of taking out with a knife the fat-gut and gills, leaving the rest of the entrails. Upon the dextrous performance of this the art of curing pickled herrings principally depends; this business is the great object of attention, and must be performed the instant that the herrings are caught, that the first drain, or what the fishermen call the life-blood, may be preserved, for it is this which gives the rich flavor to the pickle, and great care is taken that each barrel has some of this blood. Salt is lightly sprinkled over each layer of fish, and the quantity required is about one barrel of salt to three barrels of herrings. After the casks of herrings have stood from twenty-four to forty-eight hours, to settle, they are filled up, well coopered, and closed, and thus remain till the vessel discharges her cargo, when the barrels are opened, and once more filled up, which is termed repacking. The fish are then ready for market. I inclose a certificate from Mr. Hobbs, and if I can communicate any further particulars to satisfy the Society, it shall most readily be done by, Sir,

Yours respectfully,

GEO. ERRINGTON.

Yarmouth, December 1, 1807.

To C. Taylor, M. D. Sec.

CERTIFICATE.

SIR,

AGREEABLY to your desire, I hereby certify, that I have bought of you, for several years past, a quantity of herrings pickled after the manner of the Dutch, which were caught and cured by the crew of your boat, Henry Olley master. I had of you this year twenty-two barrels of the first catch, and about thirty-five barrels of the latter. In general I have been satisfied with their quality, and believe that the curing approaches nearer the Dutch in goodness, than any of the British cured white pickled herrings. This year, the first twenty-two barrels were small, but nicely cured herrings, and good flavoured pickle. The last were full roed fish, rather too much salted, but they will keep well, and be better in the spring.

I am, Sir,
Yours, &c.
TIMOTHY HOBBS.

London, November 23, 1807.

To Mr. G. ERRINGTON.

The THANKS *of the Society were this Session voted to Dr.* ALEXANDER ANDERSON, *Superintendent of the Royal Botanical Garden at St. Vincent, for the following valuable Communications received from him.*

DEAR SIR,

I AM honoured with your letter of the 26th and 28th of April, with the 21st and 24th volumes of the Transactions of the Society of Arts; also the publication on the Culture of Black Pepper, for which I feel great obligation to the Society.

From

From Mr. Martyn's account of the pepper plant, I am in hopes that it will succeed in this garden; as he says it is three or four years before they produce in the East Indies after planting, and it is now near that time since I procured them, and there are several very luxuriant at present. I am happy to find I had adopted the mode of planting them which he has described.

In general I find that East India plants are more rapid in their growth, either from seeds or plants, than the indigenous plants of the country, and arrive at perfection sooner; but the reverse is the case with the Chinese. There is at present in the garden, a large tree of the *Litche*, sent by Sir Joseph Banks in 1788, which, as yet, has made no attempt to flower. I experience the same disposition in several herbaceous perennial plants from China. I was pleased to see a specification of growth of trees in the East Indies, by Dr. Roxburgh, in the last volume of the Transactions, which led me to a comparison of some East Indian trees here, and also of some natives; and I find those from India thrive full as well here as in their native soil. The result I send you. It is a matter of curiosity, rather than utility. It shows the rapid progress of vegetation in tropical climates, compared with that in the colder regions.

Of the numberless articles for commerce and economy, manufactured in the East Indies, no attention is paid to them here, although many of them are common. The same is the case as to small products for necessary existence. This is owing to the want of a proper population, and the high price of manual labour. Except in Barbadoes, and a few other islands, all the land in cultivation is engrossed by the sugar cane. No room is left for poor industrious people, unless in detached spots remote from towns, markets, and shipping. The hard woods fit for mill timber

are more attended to than any other, and they undoubtedly are the most essential article to the planters, yet few take the trouble to plant them, or give room for them.

You mention the high price of oak bark for tanning. I am confident we have many barks here superior to it. As to the astringent principle, whether our barks are as effectual, or more so, than the oak bark in tanning, deserves experiment. For that end I will transmit you some specimens by the first opportunity. The barks might be imported at a trifling expense, unless the custom house duties should be found to prevent them. The high duties and prohibitions in the custom house prevent several people here from sending similar articles from hence, for experiments, as well as for speculation in trade. A few persons in this island wish to cultivate the cinnamon for commerce; they have asked me if it can be entered at the custom house, and what are the duties upon it? I could give them no information as to either. The overhauling and pilfering by the custom house officers in England, of articles of natural history, sent as specimens, is very injurious; such things should be held sacred.

Many articles here deserve to be subjected to experiments, from which I am prevented, by the necessary attentions to the garden, particularly for some time past. The business of it engrosses all my time and care, and is as much as one individual can attend to.

I will endeavour to obtain a correspondence with Dr. Roxburgh, but I almost despair of it during the war. I have correspondents in America whom I can depend upon, but the conveyance, through the medium of American vessels to these islands, is very precarious. Some time ago I lost a parcel of seeds from New York, sent in charge by one of these vessels. I believe I mentioned that I have lost

lost one of my nutmeg plants, for which I blame myself by too much attention in watering it in dry weather. The other thrives remarkably well, and is now above ten feet high; but if it proves a male, I am at a stand. Could I find the opportunity of sending by a flag of truce to Cayenne, I know I could get a supply.

I am, with most sincere regard,

Dear Sir,

Your much obliged

And ever grateful Servant,

ALEXANDER ANDERSON.

Botanical Garden, St. Vincent,
July 21, 1807.

To C. Taylor, M. D. Sec.

Dear Sir,

I am sorry an untoward circumstance has intervened in my correspondence with you, from which I may appear neglectful of the interests of the Society. It thus happened: On the 21st of July, 1807, I answered your letter accompanying the two volumes of the Society's Transactions, and that part of Martyn's Dictionary treating of the Black Pepper. My letter, as usual, I inclosed to General Melville, but unfortunately he had left London before its arrival. Captain Syms, who was the bearer, could neither find the General, nor get information of his residence. The Captain, a careful man, returned by the last fleet. The letter, with some other papers, as you may wish to know the contents of it, I have now sent.

I have the pleasure to inform you, that some of the black pepper plants are now pushing out freely their fructification; but have to lament, that the only nutmeg in the garden proves a male, and there is no prospect, at present, of obtaining more, as in the present situation of affairs, no communication from St. Vincent to Cayenne can be had by flags of truce or otherwise. Several plants of it were brought to Trinidad with the colony of the Chinese: I much fear they are, or will be lost there.

I send you some cloves, about two-thirds of the produce of one young tree for the first time. My reason for troubling the Society with them, is from a wish to know whether drying them in the shade or sun is the most proper mode, or if it makes any difference in the quality of the spice; if not, they may be cured in the sun with no trouble, in a very short time. The young fruit I reserved on the tree for seed, part of which was beat off by the wind, and seems to me little inferior to the flower buds.

On reading in the Society's Transactions, Dr. Roxburgh's Experiments on the Comparative Qualities of Bark of East India Plants as Substitutes for European Hemp, I was induced to try the leaves of the *Agave*, to ascertain how far the fibres of them would answer the purpose. I transmit a specimen of them for the Society's inspection. The small bundle, tied with some twine made of the same, is the produce of one moderate sized leaf, and was obtained from it, immediately cut from the plant, in a very short time. The operation was performed by a black boy. The plants are produced in abundance by nature among the rocks by the sea side and barren hills. If found useful, any quantity may be obtained with little labour and no expense of first cost. The superior advantage over the East India articles (most of them common in these islands) is the trifling labour

bour requisite to get the fibres from the fleshy substance of the leaves without steeping, or any other previous process. When macerated in water, I think it lessens the strength of the fibre, and gives it a dusky hue.

The three small bundles which I now send, were taken from two species common in St. Vincent, viz. *Agave vivipara*, and *A. cubensis*. The leaves of all the tropical species possess much the same properties. By the ancient Mexicans, the Agave was deemed the most valuable production of nature. It is mentioned by all the Spanish writers on America under the name *Maguei*.

It is to be observed, that no article in these islands, however valuable, and whatever encouragement may be held out for its manufacture, will be attended to in their present situation. The sugar cane is considered as the only plant that merits the attention of the planters.

In my last to you I mentioned barks of trees in these islands, which I conceived may become substitutes for oak bark in tanning. I transmit you specimens from five different trees, which are all common, and consequently readily procured, if they prove useful. That of the *maljughra* I know the Spaniards use on the main land with that intention. The quantity of each is purposely small, for the more easy conveyance, and prevention of difficulties at the custom house. However, they may be sufficient for ascertaining their astringent or tanning principle.

In consequence of the war cutting off most of my opportunities of correspondence, the additions to the garden are much less than otherwise they would have been; however, almost every day some thing or other is obtained from some part of the world. What I have long wished for, the Grains of Paradise, are thriving luxuriantly. By the last

fleet, a number of East India seeds arrived, many of them will be valuable acquisitions if they vegetate.

I am, with the greatest regard,
Dear Sir,
Your much obliged,
Most humble and obedient Servant,
ALEXANDER ANDERSON.

St. Vincent, Botanical Garden,
April 16, 1808.

To C. Taylor, M. D. Sec.

Table of the Growth of certain Trees in the Botanical Garden at St. Vincent.

Tectona grandis—The seeds lie in the ground from eighteen months to two years, before they vegetate. They have produced seeds in the garden ten years ago.

			ft.	in.
First seeds received from Sir J. Banks in	1788			
Circumference of stem, in	1807 at	6 ft above ground	4	6
Caryota urens, seeds from Sir Jos. Banks,	1792	Do.	4	10
Sapindus edulis, (Litche) plant from ditto	1788	Do.	4	8
Mimosa Lebbeck, seeds do.	1792	Do.	4	5
Sterculia fœtida, do. do.	1792	Do.	6	0
Gomutu Palm, seeds from Bd. of Agri.	1800	Do.	5	7
Artocarpus incisus, small plants	1793	Do.	6	1
integrifolius, do.	1793	Do.	5	6
Jambolifera pedunculata, do.	1793	Do.	5	9½
Aleurites triloba, seeds	1793	Do.	4	8
Eugenia Malaccensis, small plants	1793	Do.	3	10¼
Mangifera indica, from seeds	1788	Do.	7	0
Ditto, small plants from E. I.	1793	Do.	5	2
Natives				
Swietenia Mahagoni, seeds has been producing plenty of seeds for several years,	1790	Do.	3	4
Copifra officinalis, seeds from the Continent	1790	Do.	3	2

One of the most valuable woods.

Mimosa

Mimosa grandis, seedling plant from the Continent	1792	at 6 feet above ground	6	6
A very hard and valuable wood.				
Carolinia insignis, seeds from Trinidad	1787	Do.	8	0
The wood of no value.				

St. Vincent July, 21, 1807.

A. ANDERSON.

The THANKS *of the Society were this Session voted to Dr.* WILLIAM ROXBURGH, *of Calcutta, for the following valuable Communications received from him.*

MY DEAR SIR,

IT will give you pleasure to learn that I and my family arrived at Bengal in very good health. I have not had much time to prepare any kind of communication for the Society, but shall not be idle. I trust that I shall, by an early conveyance, receive your letter for Dr. Hunter, the Secretary of our Asiatic Society, to accompany the copy of the Transactions of the Society of Arts. Tell me what is thought of the extract of the Gaub, or Tannin, I sent you prepared from the fruit of DIOSPYROS GLUTINOSUS, or rather EMBRYOPTERIS GLUTINIFERA, *Coromandel Plants, Vol. I, No.* 70; you know you were only just put into a way of getting it from the India house when I left you.

I propose to get Mr. Cowper, the surgeon of the ship we came out in, to carry this, and a sample of the fibres of No. 3 of my last communication, on the Comparative Strength, &c. of the plant called CALOOEE by the Malays, see Vol. 24, page 148. I can cultivate this plant to any extent,

tent, as it grows readily from slips and cuttings, is perennial, and yields three or four cuttings, or crops, annually; but the cleaning of the fibres from the glutinous fleshy exterior coat, with which they are covered and intermixed, is uncommonly difficult. It has been simply scraped off in the sample I now send you, which I think you may present to the Society, though I fear this letter is written in too great a hurry for their attention. I beg of you to try to procure me all the information you can relative to cleaning such fibres. When the shoots are cut, the bark peels off most readily, but no kind of washing, coction, or maceration, that I have yet been able to think of, is of any use in cleaning or freeing the fibres from the exterior coat; the best way I have yet tried is scraping off this coat, as they do the pulpy part of the wild plantain, or ABACA at Manilla; see Annals of Botany, vol. 1, p. 200; but such a process will, I fear, be too expensive for Calooce hemp, though I know it is much stronger than any thing of the kind I could ever procure from the plantain tree, indeed next to *jeetee*; this fibre is the strongest vegetable fibre known to me.

Remember me to Dr. Bancroft, and tell him I have not forgot the orange dye, Wassuntagonda, a powder procured from the out side of the capsules of my ROTTLERIA TINCTORIA; I must procure it from a distant country.

I have put up two small samples of the Calooce hemp. No. 1 is prepared as before mentioned, by scraping off the exterior coat as soon as the bark is pulled off. This has been cut and cleaned within these two weeks. No 2 is the bark peeled off and dried in that state, and is about one year old, consequently done while I was in England. No. 1 seems to me to be as clean as the generality of Russian hemp. Pray let Lord Dundonald see this substance, and make my best respects to his lordship when you see him;

he

he may be able to advise me how to proceed in cleaning it in the first instance.

I have been this instant looking over the twenty-first Volume of your Society's Transactions, and think it may be agreeable to you to know that the tree which yields the *Gum Kuteera*, page 423, is my STERCULIA VILLOSA, and No. 1196 of my Drawings and Descriptions of Indian Plants, sent to the Honourable the Court of Directors.

I am, &c.

W. ROXBURGH.

Calcutta, Sept. 20, 1807.

To C. TAYLOR, M. D. SEC.

MY DEAR SIR,

SINCE I wrote to you, on the 20th September, by the Surgeon of the Baring, who carried for you samples of the Malay hemp, called Calooce. I have received your letter of the 7th of March, intended to overtake me at Portsmouth, and I thank you for the pains you have taken about my Myrobalan galls. If the value of them is, by this experiment, ascertained, I shall the less regret the great loss I have sustained by them. You will be able to learn this from Mr. Desanges, and let me know.

You have now learned how to get a Treasury Order for any thing I may send the Society, I shall therefore be encouraged to trouble you oftener, and just now with four pounds and a half of the extract of Gaub fruit, (EMBRYOPTERIS GLUTINIFERA, *Coromandel Plants, Vol. I. No.* 70,) which is at this instant in perfection, and the extract is made with cold water. The former, which by the above mentioned letter I learn you were about to receive, was made

made with hot water. The fruit to make this quantity of extract, four pounds and a half, cost sixpence, and the expense of making may be as much; this information will the better enable the Society to ascertain whether or not it can be useful to tanners, or others, in England. The rate of freight you can better determine than I can here.

The little box is not quite full with the extract. I have filled it with Calooee hemp, the produce of the second cutting of the same plants in two months, so I may safely conclude four crops, or cuttings, may be had annually.

I am, &c.

W. ROXBURGH.

Calcutta, Nov. 3, 1807.

To C. Taylor, M. D. Sec.

My dear Sir,

To convince you that I have not forgot the Society nor you, I send you, above, copies of two letters which I have written to you since my return to this place. I also inclose a letter from the Secretary of the Asiatic Society, to convince you that I have been a faithful agent for establishing connections between the two Societies.

If you value our labours as we do ourselves, the original Calcutta price of each volume being fifty rupees, or half crowns, you will also see we have not been insensible of the attentions of the Society of Arts.

I am not relaxing in my pursuit after substitutes for hemp and flax; some more experiments are beginning, and are very far advanced, which promise success, that is, cultivating our sun, or Indian hemp, during the dry season, as practised at or near Bombay, and at Malabar, where their

their sun or hemp has been reckoned in London equal to, if not better, than the best Russia hemp.

Canvas is now made here in very large quantities, by two or three clever Europeans, from the common sun plant of this country, of so very good quality, as to have nearly superseded English canvas throughout India. This is gaining a great point, if England should ever be pushed for the raw material, as the freight of canvas from hence to Europe will be trifling when compared to the freight of the raw article.

I was told in England that lignum vitæ was becoming scarce and dear. I am inquiring after a substitute, but hitherto without any pointed success. Should I meet with any kind of wood that promises well, I will send the Society a specimen, and another specimen of a kind of very beautiful elegantly veined black wood for furniture, called here *Seet-Saul.*

I remain, your's, very sincerely,

W. ROXBURGH.

Botanic Garden, near Calcutta,
Feb. 9, 1808.

To C. Taylor, M. D. Sec.

PRE-

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CV. A MODEL of a swivel-headed Churn Staff, to facilitate the making of Butter, by Mr. T. Fisher. See page 131.

CVI. A Trocar and Canula for discharging the rarefied Air from the Stomach of hoven Cattle, by Mr. W. Wallis Mason See page 128.

CVII. A Specimen of English Rhubarb, by Mr. William Maud. See page 249.

CHEMISTRY. CLASS II.

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XIII. Samples of Fruit preserved without Sugar, by Mr. Thomas Saddington. See page 145.

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No.

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CCLIV. A Model of an improved Anchor, by Captain H. L. Ball, R. N. See page 170.

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CCLVIII. A Model of the Swedish Telegraph for conveying Intelligence, by Sir A. N. Edelcrantz. See page 184.

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No.

CCLXI. A Wrench for Screw Nuts of various Sizes, by Mr. W. Barlow. See page 199.

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A

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R. WILKS, PRINTER,
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ANALYTICAL INDEX

TO THE FIRST

TWENTY-FIVE VOLUMES,

OF THE

TRANSACTIONS OF THE SOCIETY

INSTITUTED AT LONDON

FOR THE

ENCOURAGEMENT

OF

ARTS, MANUFACTURES,

AND

COMMERCE;

TO THE TERMINATION OF THEIR SESSION, JUNE 1807.

LONDON:

PRINTED BY R. WILKS, CHANCERY-LANE.

Sold by the HOUSEKEEPER, at the SOCIETY'S HOUSE, in the ADELPHI; and by Messrs. ROBSON, J. WHITE, BECKET, JOHNSON, CADELL and DAVIES, PHILLIPS, WALTER, RICHARDSON, LONGMAN and REES, TAYLOR and WYATT.

MDCCCVIII.

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R. WILKS, Printer, 89, *Chancery lane.*

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